THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME XC., No. 20. Whole No. 1,771. | NEW YORK, MONDAY, MAY 17, 1909. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. H. WADELTON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

Published on each Monday of the year, at No. 42 Pine Street, New York City.

Telephone.—2906 John.

Terms of Subscription, Including Postage.—For the United States, $3; Canada, $4 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Indexes for the previous 6 months will be found in the First number of July and the First number of January.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them. All payments to be made in advance. Single copies, 10 cents.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

NOTICE—
Wrinkle Department, American Gas Institute.. 869
Our Half-Century Special Number..... 869
EDITORIALS—
Briefly Told 869
The Electric Illuminating Engineering Society—Current Mention.
Review of the Twenty-fourth Annual Report, Massachusetts Board of Gas and Electric Light Commissioners.—No. V 870
Proceedings, Thirty-ninth Annual Meeting, New England Association of Gas Engineers—Continued from Page 633 871
First Day, Afternoon Session—*Calorimetry, by Mr. J. D. Klumpp—Discussion.
*Sheaves of the Coal and Gas Plant, by "Engineer"..... 877
Proceedings, Fifth Annual Meeting, Illinois Gas Association—Continued from Page 829.. 878
First Day, Afternoon Session—*An Investigation of the Effects of Compression and Transmission on the Candle Power and Heat Units of Manufactured Gas, Part II.—By Messrs. V. A. Houghton and S. L. Cole.
Valuation of Coal Tar Pitch 881
BUREAU OF INFORMATION, THE AMERICAN GAS INSTITUTE..... 882
Addition to Addendum to Question No. 48.
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 882
Mr. Hicks Goes to Boston—Organization Meeting, Cincinnati, O.—Gas Works for Uvalde, Tex.—Resignation of Mr. L. B. Sharp—To Sell the Hampton (Va.) Plant—Obituary Note, Mr. Jas. Salter—Personal—Mr. M. E. Malone Goes Abroad—The Western Gas Construction Company's Desk Blotters—Good Attendance, Adrian, Mich.—Holyoke's Output—Proposed Gas Works for Brandon, Manitoba—Contract for the Grinnell (Ia.) Works—Mr. Searle's Hat Still Fits Him—Mr. Stuernwald Goes into the Handkerchief Business—The Railroads of New York, Connecticut and Massachusetts, May Get Their Cylinders in at 35 per cent. *ad valorem*—Redlands (Cal.) Wins—Something from Columbus, O.—Mr. Coyle Grows Gracefully Old—And Other Items.
The Market for Gas Securities..... 884

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

OUR HALF-CENTURY SPECIAL NUMBER.

Next month we complete our Fiftieth Year. To commemorate it fittingly the proprietors have determined to print a special issue, on the pages of which will be given a fair history, and at some length, of the progress made in the gas industry since the JOURNAL first appeared to champion the cause. The issue is to have 100 pages, with special cover, the size of the pages to be even with those in the regular edition. One-half the issue (50 pages) will be given to the publication of articles (14 in number) on the leading phases of gas manufacture and distribution, the sketching of the articles to be historical. These articles are in course of preparation by men whose eminence in the profession cannot be gainsaid, and each of them is addressing himself to a subject regarding which he undoubtedly possesses expert knowledge. The remainder of the issue will be given over to advertising, the rates for which are as follows:

One page $50.
One-half page $25.
One-quarter page $13.

The cover pages, inside and out, have been engaged (these were let at figures approximately 200 per cent. higher than the "inside,") and 40 of the interior pages have also been contracted for. The edition will go free to everyone of our regular subscribers and advertisers, and extra copies will be furnished at the rate of 50 cents each. No concession in price will be made for orders for extra copies to anyone. Those who desire to advertise, and those who wish to secure extra copies, should address the publishers at once. No undue claim to excellence is made when it is stated that this special issue will contain more in value to the fraternity than was contained in any other issue of any gas news periodical ever printed.

BRIEFLY TOLD.

THE ELECTRIC ILLUMINATING ENGINEERING SOCIETY.—"At the New York City Armory of the 22d Regiment, N.G.S.N.Y., there was held, on the evening of the 6th inst., a meeting, which gathering was presumed or supposed to represent the very *elite* amongst illuminating engineers, and was meant to be the occasion when public lighting conditions, chiefly in respect of their hitching up with the electric current, were to be portrayed. It is true that some of the conditions were portrayed, and, in fact, some of the lamps mainly

MAY 17 1909
SMITHSONIAN DEPOSIT

through the agency of which the portraying was to be done were hanged about the room in such manner as to shine directly in the human lamps of the auditors. Again, most of them were of the well sung tungsten variety; for, as an auditor or two near to the writer remarked, 'They certainly are of the tungsten variety, for none other could be so blinding.' The one who was to speak on electric street lighting, or to be more specific, 'Art in Public Lighting,' was preceded by an amiable political spellbinder, who is out of office at present, and the meeting of the Society proper did not commence until perhaps an hour after schedule time. The story of 'Art in Public Lighting' was illustrated by means of some 20-odd slides, showing the fixtures supplied in New York city by the Edison Company, eked out by an addition of 10 European views. Many people must have been unaware that all of the art along these lines in this country was the private monopoly of the New York Edison Company, so many will have to confess their need of ignorance in such respect in view of the impartial (more or less) statements of the speaker. It would not be altogether true to state that no gas lamps were shown during the progress of the describing, for there were three or four, which had either been abandoned, or were about to be, and possibly upon latter account were set forth as representative of the conditions in street lighting by gas. It is positively true, however, that nothing was said about the 40-odd thousand gas lamps that are doing satisfactory service nightly throughout the Greater City. Electric lamps are as scarce as are persons inciting to disorder in the streets of the Greater City, but they were the only type shown. An upright, high pressure gas lamp, was shown as a sample of lighting in London, but nothing was either heard or shown respecting the inverted type. Everyone listened with close attention to the words that were emitted by the gifted speaker, who actually received an ovation when he stepped down from the platform out in the open. The members and guests then journeyed to the main floor to inspect the exhibit of street lighting fixtures, which showed the development historically of the oil lamp on wooden post to the most modern forms, both gas and electric. This exhibit is by far the most interesting of the great collection assembled by the Municipal Art Society and the Committee on City Planning."—SPECTATOR.

CURRENT MENTION.——

THOSE who propose to take advantage of the opportunity afforded by advertising in our special number, commemorative of our 50th year, should not wait to send in their requisitions for space, as the the month (July) for its appearance is close upon us. Of course, publishers, in common with other business men, naturally aver that their own is the best, and we are not at all backward in giving utterance to a like sentiment. Our main reliance for such belief is in the fact that the number will contain not less than 12 articles on separate subjects, all germane to the industry, and all especially prepared by men whose reputation as gas engineers and managers is international. Suppose we name a few of these: The Dean of the North American gas industry, Mr. William H. Pearson, has consented to write up "The Last Half Century in the Gas Business of Canada;" Mr. Norton H. Humphrys, who has acted as our Special English Correspondent for well over 30 years, and whose monthly messages have certainly been read with interest by the Editors, at any rate, will tell the story of the progress of the gas industry in Great Britain in the half century; Mr. Fred. Bredel will handle the matter of gas bench construction; Dr. A. H. Elliott will write on the story of advances in gas chemisty; Dr. A. C. Humphreys will recount the forward steps taken in the education of the gas engineer; Mr. Philmer Eves, of Indianapolis, is to discuss the organization and carrying on of new business departments; Mrs. Helen Armstrong will write up on demonstration practices; and Uncle "Jerry" Howard is to narrate the history of his really wonderful career. Dr. Hilgenstock will describe current practice, in treatment of certain residuals—notably ammonia; Mr. Carroll Miller is down to prepare a general article on residuals; Mr. John A. Britton will write the history of "The Gas Industry on the Pacific Coast for the Half Century;" Prof. Albert H. Ganz will have to do with the purpose of the electric current and its connection with the lighting industry for 50 years; Mr. Donald McDonald, of Albany, N. Y., is to describe the advances made in the gas meter in the 50 years; the gas coal trade of America will be written up by that much loved veteran, Mr. Jas. D. Perkins; and Mr. Henry L. Doherty will handle the output of a half-century's history in the financing of gas companies. Several others, of equal prominence have promised to contribute to matter that will mark our semi-centennial, and we make no error whatever in saying now and positively that no other number of any gas publication that ever was printed, will approach in importance the JOURNAL'S special issue for the marking of the beginning of our second half-century.

MR. THOMAS F. HAYWARD, in a circular letter dated May 3d, in Baltimore, Md., makes known that the business heretofore conducted by him under the name of Bartlett, Hayward & Co., has been incorporated under the applying laws of Maryland. Mr. Hayward retaining 14,992 shares of the 15,000 shares issued. The only object of this incorporation is to "perpetuate the business and enable it to be continued in the event of the death of Mr. Hayward. It is not contemplated or intended to make any change during his life, and he will continue the business as formerly."

[Continued from Page 822.]

Review of the Twenty-Fourth Annual Report, Massachusetts Board of Gas and Electric Light Commissioners.—No. V.

[Prepared for the JOURNAL, by MR. H. THURSTON OWENS.]

This chapter concludes our review of this most interesting, comprehensive and easily comprehended Report.

OPERATION.

Coal Carbonized.—The number of tons of coal carbonized shows an increase throughout nearly all the listings. A notable exception, however, being shown by the Boston Company, which used only 19,000 tons of bituminous coal, as against 27,000 the previous year. The greatest number of tons is reported by Cambridge, where 39,662 tons were carbonized, as against 34,686 tons in 1907. The percentage of cost of coal returned through receipts from residuals shows substantial increases. The most notable examples are appended:

Company.	1908. Per Cent.	1907. Per Cent.
North Adams	72.43	72.31
Lowell	62.83	60.19
Salem	59.65	45.19
Newton	56.85	48.25
Taunton	52.45	51.34

The smallest in 1907 was Malden, with 5.43, while in 1908 the smallest was Boston, with 9.75 per cent.

Water Gas.—The figures for water gas show the same increase as those for coal gas, Boston reaching the two billion mark.

Analysis of Income and Expenditure.—The figures of the 16 largest companies are given in great detail. Seven of these show receipts, from private consumers, of over $400,000, as against only four for the previous year. One company (Lowell) received over $100,000 for residuals, which represets nearly 18 per cent. of the total income. The income from manufacture of gas per 1,000 sold, ranged from $.77252, at Boston, to $1.4364 at Salem. The revenue received by the gas companies in New York city is larger by 50 per cent. than the total income of any company in Massachusetts excepting Boston.

Expenses of Manufacture.—The figures which follow show the lowest and highest totals for the past 2 years, of cost per 1,000 on gas *made:*

Total Cost of Manufacture.

1907.		1908.	
Fall River	$.26875	Fall River	$.33081
Newton	.76162	Newton	.72712

Net Cost in Holder.

Fall River	$.26856	Lynn	$.28461
Newton	.58583	Newton	.49857

There are, however, good reasons for the Newton situation, in that it is entirely at the mercy of the freight combine.

The city of Lynn also has the lowest cost per 1,000 *sold* of gas made and purchased, the figures being $.29948. Ten of the 16 companies show lower figures in this respect than in 1907.

Expense of Distribution.—In 1907 there were eight companies whose cost of distribution was less than $.10 per 1,000 sold, while in 1908 there were only four. The lowest for the latter year being $.06265. The average cost in Greater New York for 1907 was $.078 per 1,000 sold; the lowest being $.0563.

Total Cost.—In 11 of the 16 companies the total cost of manufacture, purchase and distribution of gas, less residuals, was less in 1908 than the year before. Lynn leads for both years, the figure for 1908 being $.51377

Public Lamps.—The importance of public lighting to central stations is well shown in the amount of current generated for this service. In 14 companies it exceeded the quantity sold to commercial customers.

Gas Lamps.—The number of public gas lamps is given, and an increase of over 1,200 is divided among 21 companies.

The electric lamps outnumber gas lamps 2½ to 1, which is not to be wondered over, as there are nearly as many gas lamps in Rio Janeiro, Brazil, as there are in the whole State of Massachusetts.

ACCIDENTS.

The report includes the usual detailed statement as to accidents and it is gratifying to learn that the number was considerably less than in the previous year.

[Proceedings, as Furnished by the Secretary.—Continued from page 633.]

PROCEEDINGS, THIRTY-NINTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held in Young's Hotel, Boston, Mass., Feb. 17, 18, 1909.

First Day—Afternoon Session.

The Association reassembled at 2:55 P.M.

The President—We will now listen to an address by Mr. J. B. Klumpp, of Philadelphia, Pa., on the subject of

CALORIMETRY.

Mr. Klumpp's address was as follows:

Mr. Chairman and Gentlemen—When I was first asked to give a little talk on calorimetry I had not the opportunity to prepare a paper that could be printed for your perusal before the meeting; but, having been for some time more or less closely connected with this subject, I thought I might make a few remarks that would be of interest to you.

The practice of calorimetry in the United States has not been particularly general among gas companies, especially the smaller ones. The larger gas companies, appreciating what this subject means, have gone into it rather extensively, and are making calorific readings of of the gas every day; at some works, every hour. We must appreciate that the Germans and the English, especially the former, have gone into the study of gas calorimetry, and are now supplying most of the gas according to its calorific value. The candle powers delivered are low, as nearly all of their gas illuminating burners are of the Welsbach type, the results of which depend upon the calorific power of the gas. In England, where I had an opportunity of going over many of the plants, I found the general policy is to reduce the candle power of the gas, but to retain the calorific value higher in proportion than the drop in candle power would be. About 10 or 15 per cent. of the total gas supplied is water gas.

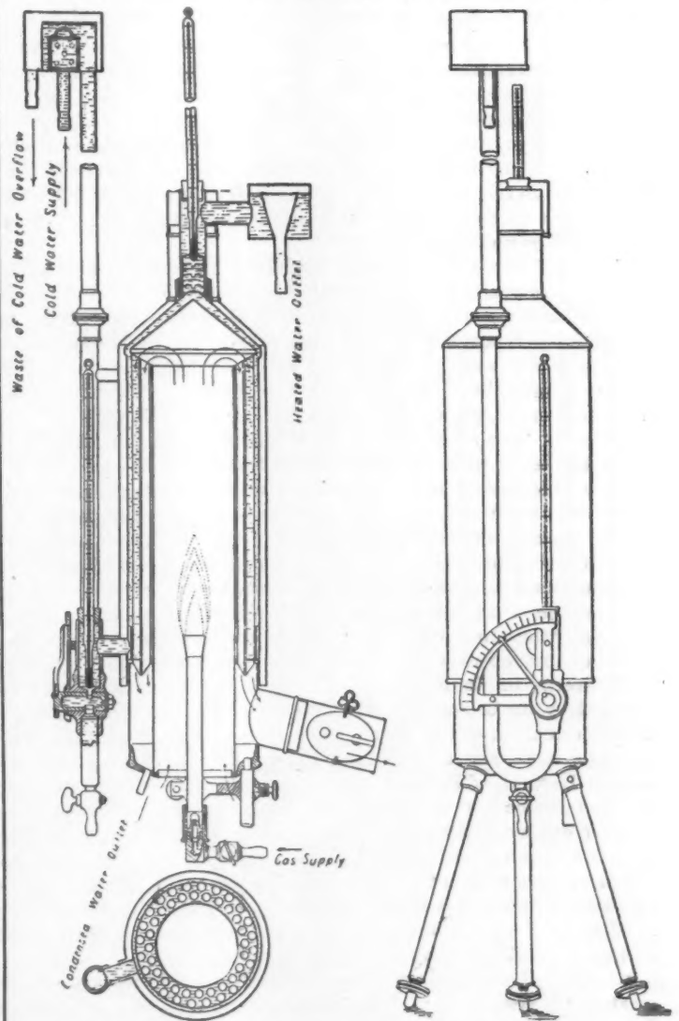
The legislation in this country, by the various State and municipal authorities, is showing a tendency to adopt the calorific power of the gas as a standard of value, and I believe one State—Wisconsin—has adopted calorific qualifications only in the supply of gas, disregarding the illuminating value, and this was done after a public hearing before quite a number of engineers, and an examination of the candle power and the calorific power supplied throughout the various companies of the State, as they were convinced that, with the present methods of manufacture of artificial gas, a good heating value meant at any rate a fair illuminating value. This State has adopted a 600-heat unit basis. There is no reason, in my opinion, why a 600-heat unit basis should be adopted, any more than a 2-cent railroad fare per mile. It is apparently independent of any actual figures of production or cost. Six hundred is a round number, just the same as 2 cents. There is no reason why it should be 600, any more than 595 or 602, or any other figure; but, being a round figure, slightly below the average supply of the State, it was adopted, and this heating value has been followed pretty generally throughout a good many places. They allow a minimum value of 550 heat units, but require a monthly average of 600. The water gas plants of this State are running with a rather high candle power, and their heating values have been in the neighborhood of 650 and 660; whereas, some of the smaller plants have not been able to deliver an average of over 585. I think probably there is a greater variation in candle power, but these smaller works do not know exactly what results they are getting. They cannot afford to employ labor of a class that will operate scientific apparatus to make enough determinations to maintain a uniform condition of operation.

Gas calorimetry has been used in connection with various trades outside of urban gas supply companies. The steel furnace, the gas engine people and the producer gas people have been judging the quality of their gas solely by its calorific value, although they have at times expressed the value of a gas somewhat differently from that adopted by our companies, and are referring to the net heating value, as much of their gas is used for power purposes, and they have been unable to utilize the latent heat of the products of combustion in developing power.

The calorific value of a gas is its heating value, generally expressed in the total amount of heat produced in burning 1 cubic foot. This heating value is expressed in this country in British thermal units, or B.T.U.'s, which is the heat required to raise 1 pound of water 1° F. This is for water at its maximum density, or about 39° F., but is practically the same for water at other working temperatures. I suppose the best way to show you how the calorific value of the gas is obtained is to describe a calorimeter, and the general methods employed in reading the heating value.

We find in actual practice that the best method to determine the amount of heat produced in the consumption of a given quantity of gas is to transmit that heat to a certain known quantity of water. Other methods are adopted, such as heating metals and measuring their expansion, and heating columns of oil and noting the expansion.

About 15 years ago Herr Hugo Junkers, after making a thorough study of the subject for several years, constructed a type of calorimeter (Fig. 1), that has been in general use ever since. After 2 years'



JUNKERS CALORIMETER. SECTIONAL VIEWS AND ELEVATION.

Fig. 1.

investigation of all the available calorimeters, a committee that I have been working with could find to-day no improvement over this instrument, except in general adaptability of operation. To describe the Junkers calorimeter, I have here a large sectional drawing. The calorimeter consists of a water heater, the water coming through the calorimeter at the bottom and going out of the top. The supply of water is controlled to a uniform heat by a small weir and overflow. The outlet water is controlled in the same way. To get comparative readings, the supply of water must be constant. In other words, the flow of water should be uniform, and the rate of gas burning must be uniform. With these conditions constant the rise in temperature will be uniform. In the calorimeter the central part is a combustion chamber, and the gas flame, as designated, is a Bunsen flame, producing complete combustion of the hydrocarbons. The flame must not be allowed to impinge upon any of the interior parts of the calorimeter. Such impingements might produce incomplete combustion. The products of combustion rise through the calorimeter and go down, opposing the flow of water. The section shows that the

products of combustion go down through these little tubes and escape at an opening in the lower part of the calorimeter, which opening is controlled by a damper.

Every calorimeter has a heat absorbing capacity that should not be exceeded. Too much gas burning will produce inaccurate results, as will too little gas. The Junkers calorimeter was designed to measure gases of varying heating values, from 100 to 1,000 B.T.U.'s per cubic foot, with accuracy. The water supply is controlled through a micrometer cock, the handle of which is an arm moving over a graduated quadrant, so that you can always set this cock at a predetermined opening. The temperatures of the water are taken exactly as it enters the calorimeter, and at the outlet exactly as it leaves the calorimeter. This calorimeter will absorb from 40 to 60 B.T.U.'s a minute with the best precision.

One point should be considered in designing a gas calorimeter; that is, the flow of water should always be contrary to the flow of gas during its course through the instrument, the hottest point of the calorimeter being at the top of the combustion chamber and the coldest at the lower part, or at exhaust outlet. Several designers recently have constructed calorimeters and have entirely neglected this point. They have allowed the water to go up and down 3 or 4 times through the calorimeter, and the gases to go directly through once, and it is impossible to regulate the temperature of the water so that it will be uniform at the outlet.

In one of our tests we found that the heat from the combustion chamber was conducted or convected directly to the bulb of the upper thermometer, without being transmitted to the water. This caused the outlet thermometer to read higher than the discharged water, and the efficiency of the instrument to be over 100 per cent., or gave the gas a higher heating value than it really had. The water in this same instrument, passed through, heated very irregularly.

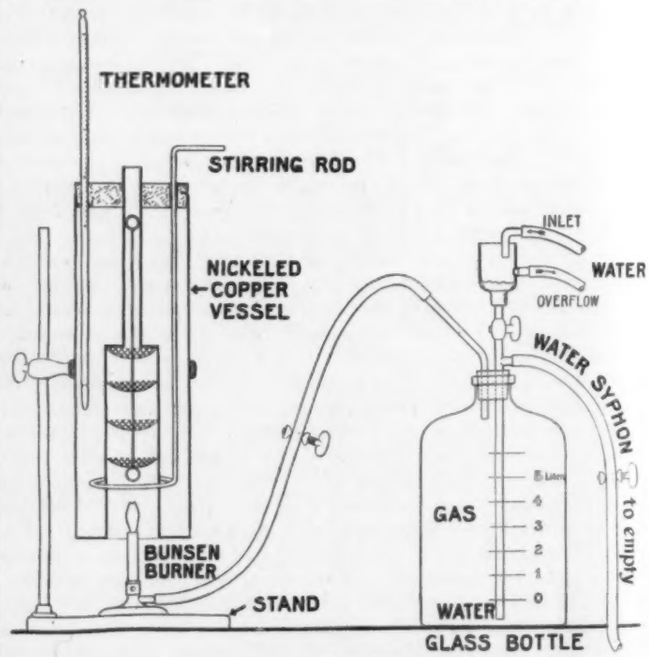
As far as measuring the volume of the gas goes, the adoption of the meter seems to be the simplest and best form. We measure gas for our photometers through a small wet meter, and there is no reason why we should not use the small wet meter for measuring the gas for the calorimeters. The quantity of water in most calorimeters is measured volumetrically with graduates, but the Committee for the American Gas Institute thought it was best to weigh the water. We are expressing our heating value in B.T.U.'s, which is an expression of the cubic foot, pound-degree, and there is no reason why we should not operate our calorimeters so that they would give results directly in English units. We measure the gas in cubic feet, weigh the water or measure it in pounds and take our readings in degrees Fahrenheit, and the product of the three is practically the heating value of the gas in British thermal units, without using any constants. In England it seems incongruous that they should measure the gas in cubic feet, use Centigrade thermometers and measure the water in cubic centimeters, and then express their results in greater or lesser calories, and then, if desired, multiply the result thus obtained by some constant to get British thermal units. If the water is expressed in pounds we could use a weighing scale that will give hundredths of a pound direct; or, if we want to measure it, we could adopt a graduate that was graduated in pounds direct.

In using calorimeters we found that the thermometer was one of greatest sources of error. The average thermometers supplied with the calorimeters in this country are apt to be anywhere from one-tenth to one-half degree out. If we are measuring a rise of temperature of the water of only 15° F., then a difference of ½ a degree would throw your results off one-thirtieth, or about 3 per cent., which, in a 600 heat unit gas, would be 18 heat units. I believe that all thermometers should be actually calibrated before using. If you have not had a chance to calibrate your thermometer you can find the reading of one thermometer in terms of the other, which has been satisfactorily done, and construct a curve of one with the second one as a basis. You will then have the exact rise in temperature; but when ordering thermometers for a calorimeter I advise you to have them certified by some competent authority. Have a correction curve drawn so that you can get the exact error of the thermometer at the point at which it is being used.

Another type of water heating calorimeter is shown, the Boys calorimeter, which has been adopted by the London Referees in measuring the calorific value of London gas. This instrument, while quite accurate for certain work, has several objections for American practice. Its capacity is very limited, and, while it is serviceable for certain kinds of gas, it might not be serviceable for gases of a greater or less heating value. The burner used consists of 2 small Bray tips of the illuminating-flame type. In making a test of this calorimeter, we substituted a Bunsen burner in place of the Bray, and got just as good results. The combustion takes place in a central chamber, and the products pass around a series of water coils. These coils are covered with spiral wires, so as to give the greatest amount of radiating or absorbing surface. The exhaust gases leave the instrument through 4 or 5 holes in the top, and there is no way of satisfactorily controlling the amount of air going through the instrument, except by placing corks in these holes. The water enters at the top, on the side, passes through the coils and goes over the combustion chamber and out at the central top. It opposes the flow of gas all the way. The methods of taking the temperature are probably very accurate. They seem to indicate the inlet and outlet water exactly at the temperature at which it enters and leaves the machine, and with this calorimeter we have been able to get results very close to the Junkers; but it is very unhandy to operate. You have to lift the upper part of the calorimeter from the base to light and inspect the burner, and, as the upper part is connected to the water supply, the overflowing water is apt to go up your sleeve while you are doing it.

The Committee of the American Gas Institute recommended the water heater type calorimeter, and a calorimeter that will only read the gross heating value of the gas.

Other types of calorimeter are on the market that read otherwise. They are gotten up inexpensively and cheap, and are supposed to give quick results; but these are to be avoided, as they do not give what we are after. We have here such a calorimeter, called the Graefe



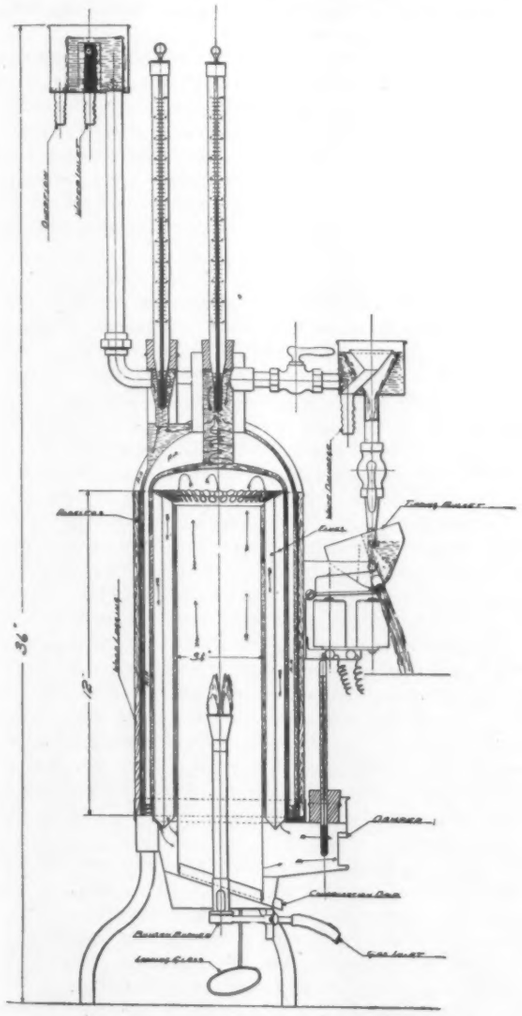
THE GRAEFE GAS CALORIMETER.

Fig. 2.

calorimeter; small and convenient, but not a good, practical instrument. In the first place, it reads the so-called net heating value of the gas, and, as a commercial gas man, I would condemn a calorimeter that reads only the net heating value. Therefore, I do not think this a practical instrument for our work. It has a small cylindrical vessel containing a fixed quantity of water. This water must be changed at each reading, and should at first be at normal temperature. A small Bunsen burner is placed under this water column. The gas is not measured by a meter. It is measured by displacement, and that displacement takes place in a graduated glass jar. The water, rising in the jar, displaces the gas above it. The graduations will indicate the quantity of gas consumed. The gas in burning transmits its heat to the water in the calorimeter proper. The gas exhausts at a temperature so high that it carries off the water formed in combustion. That naturally should give a lower value than a calorimeter that condenses the products. It not only gives you a less value by the latent heat of water formed, but it gives you a less value due to losses from the high sensible heat of the gases expelled. For instance, if it is operated with the gas outlet at 150°, carrying off all the water, there will be a loss in sensible heat, possibly from 10 to 20 heat units. But this heat is lost in addition to the latent heat, and so it is not a calorimeter that will give any definite value, depending entirely on the temperature of exhaust gases. While it is portable,

and only costs $25, it gives results that do not indicate the true heating value of the gas.

There are calorimeters of the Junkers type that are arranged very conveniently for commercial practice. In one of them, the Sargent calorimeter (Fig. 3.), the water is electrically and automatically



THE SARGENT CALORIMETER, SECTIONAL VIEW.

Fig. 3.

switched to-and-from the weighing vessel by a contact from the gas meter-head, which is very commendable. The water is weighed on scales to 1 one-hundredth of a pound. The thermometers are placed close together at the top of the instrument and are conveniently read. This is a very practical calorimeter, and in its latest improved construction is adapted to good commercial gas practice.

Another style of calorimeter that has been put into somewhat limited use is the Doherty. This calorimeter measured the gas by displacement, which takes place by water falling from one chamber to another, at the same time the water is heated. There you have a known quantity of water and a known quantity of gas, and, having the rise in temperature of the water, you get directly your heating value of the gas.

As I said before, there are various other types not serviceable for our use. For instance, one calorimeter heats one leg of a double column of oil, and that leg as heated expands and rises. The difference in elevation of the two legs of oil determines the heating value of the gas. Such types are not adaptable to commercial practice, because they do not measure the latent, or all of the sensible, heat of the products of combustion.

Dr. Immenkoetter, a German, made an exhaustive study of the Junkers gas calorimeter, who found that it was a very efficient instrument. He went through a series of tests that were very elaborate and covered a good deal of time, and determined the efficiency of the calorimeter. We were unable to duplicate his work, but made efficiency tests in another way. We put an electric heater in the calorimeter in place of the Bunsen flame. We heated that coil by a current, and, knowing absolutely the voltage and amperage of this current, were able to determine exactly how many heat units we put in the electric coil. Then we operated the calorimeter the same as burning gas, and obtained an efficiency of 99.5 per cent. upon an average of about 10 readings. We also tried it with another calorimeter, and practically duplicated the work. So, as a scientific instrument, I think we could class the gas calorimeter ahead of many of our gas measuring appliances, not excepting metering or photometry. I think the gas meter itself is apt to show more error than the other calorimeter observations.

Several important precautions are to be taken in operating the calorimeter. Reduce the products of combustion at the exhaust outlet to the temperature of the air, which you can do by having the entering water at the temperature of the air, then you practically get rid of all errors due to humidity and variations in atmospheric conditions. The outlet of the instrument is jacketed by the entering water. Then, if the water goes in at the temperature of the air it means that your outlet gases at this point are practically reduced to the temperature of the air, and every heat unit shown by the instrument is a heat unit transmitted by the gas.

Take the temperatures of the water often, and at uniform intervals, so that the average heating is exactly obtained.

Always measure the gas by complete revolutions of the gas meter drum, as indicated by the large hand of the meter.

The calculations to determine the heating from observations made are very simple, when confined to English units, and no constants are necessary.

There is a computer designed to give these in a few seconds, at the same time correcting the gas for variations in volume due to changes in barometer and temperature.

As regards the gross and net heating value of the gas, I think I might read a clause from the rules and regulations of the Wisconsin State Commission, which were recommended by their engineers, who were scientific men connected with the University of Wisconsin:

"The common method of expressing the heating value of a gas is in the number of British thermal units, generally abbreviated B.T.U., developed upon the combustion of 1 cubic foot of gas, as measured under standard conditions of temperature and pressure. Some authorities prefer to express the heating value of a gas as the so-called 'net heating value,' which is obtained by subtracting from the total number of heat units liberated the heat units which are liberated by the water formed in the products of combustion in cooling from vapor at the boiling point to water at that temperature to which the products of combustion are cooled.

"It is true that, for most purposes to which gas is applied, this latent heat of the water of combustion does not become available; but there are other uses to which the gas is put in which this heat becomes useful. There are few, if any, gas consuming devices in commercial use which utilize all of the heat which is measured on a standard calorimeter, the percentage of loss depending upon the temperature at which the products of combustion escape. It appears, then, that for purposes of standardizing a gas in such a way as to avoid bringing into consideration the kind of burner in which is is employed, and the purpose for which it is used, the standard should specify the total heat which is liberated by the gas. Consequently the total heat value, sometimes called the 'gross value,' is recommended as the standard."

If we should take a steam engine, and want to determine the amount of heat utilized, or the efficiency of the steam engine, we would not say 1 pound of steam at 100 pounds pressure contained only 337 heat units. We would say that it contained a total of 1,184 heat units. If that engine is running non-condensing it discharges the steam as steam. The latent heat is not used, hence there is no reason why, in determining the efficiency of a gas engine, the total heat should not be considered. The gas engine manufacturers are making their guarantees on a basis, say, of 10,000 B.T.U's. per brake horse power hour, and as they can never make available the latent heat of the hydrogen contained in the gas, as their exhaust products go off at such temperatures as 500° to 1,000°, they wish to cover their guarantees, so that the latent heat will not be included in the heating value of the gas. That might be so, but they exhaust anywhere from 20 to 50 per cent. on the total heat in the gas in the shape of sensible heat, and it practically is no argument why the latent heat should not be counted as heat in the gas. In fact, there are any number of latent heats, depending upon the temperatures of discharge of the exhaust products. If the heat units were expressed as net heating value, you could put in an instrument or appliance that would give an efficiency of over 100 per cent., which is rather an absurdity. The Wisconsin authorities, appreciating this fact, said that the total heat value was naturally the total heat that can be produced from the calorimeter, and the calorimeter is the only instrument that will measure consistently the total heat, or any heat. There is no instrument to-day that will

measure accurately the net heat, as it is generally the sensible heat, less the latent heat. You can take the same calorimeter and burn a quantity of gas, and measure the condensation, and in that way can figure out approximately the net heating value; but it is not certain, because your gas and air might go in at a saturation point of 70° and go out saturated at 100°. You are losing some heat in that way, though, of course, it is very small; but it is not an argument for using the net heating value. If the gas engine people desired to use net heating value, they could call it by some other term; the effective power value, for instance, which means that the balance of the heating value is never effective for power. The charts before you indicate generally the relation of heating value to candle power of carburetted water gas.

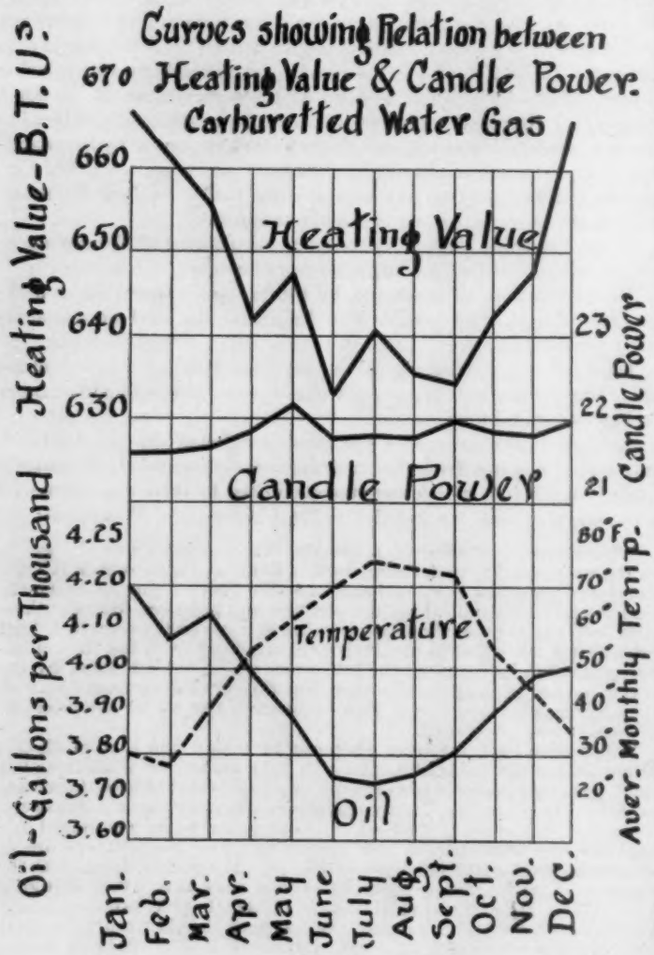


Fig. 4.

The heating naturally varies with the candle power, although there is a definite relation between them; that is, the heating value cannot definitely be calculated from the illuminating value. It varies with the character and method of manufacture of the gas. It is, of course, very different with carburetted water gas and coal gas. With carburetted water gas the heating value is a function, both of candle power and oil efficiency, and also of the quality of oil and the method of its gasification. It might be said to vary with the quantity of oil used.

This chart shows the results of a year's readings on both heating value and candle power, taken over a mile from the works. It will be noted that the gas has a uniform illuminating value of from 21½ to 22 candles; while the heating value varies from 635 to 665 B.T.U.'s. This heating value varies with the temperature of the atmosphere, which is indicated by the lower dotted line, these temperatures running from 28° to 75°. These are all average monthly readings, each one representing from 50 to 60 readings per month. The temperatures are an average of the daily means, which in turn are the average between the daily maximum and minimum.

[Mr. Doherty—The best candle per gallon there is 5.92.]

The heating value curve is found to follow closely the curve indicating the quantity of oil used. In winter with low ground and air temperatures it is necessary to use more oil to maintain an equally distributed candle power; therefore, the heating value is increased. The lost candle power is due to the deposition of the lighter and so-called unfixed illuminants which give a decided loss in illuminating value without a corresponding loss in heating value. There is probably a method of determining the heating value of a carburetted water gas. The straight water gas has a definite heating value, and each gallon of oil gives an additional heating value dependent somewhat upon the method of manufacture.

With coal gas I have not been able to tabulate any figures to determine definite results. It is, however, certain that the few candles dropped do not mean a proportionate reduction in candle power. The benzoles are deposited first, and reduce candle power, say the loss of one candle. This should not reduce heating value more than 10 or 15 heat units, while in both carburetted water gas and coal gas the remaining candles should have a considerably higher heating value per candle remaining. Thanking you for your attention.

Discussion.

Major Hinman—Mr. President, Mr. Klumpp has given us an extremely interesting paper on a subject of great importance now, and which in the future, in my opinion, will be of much more importance. As many of you know, he has done a great deal of work on a Committee of the American Gas Institute. I think he has given us his latest results. It might be well to call the attention of the members to the work that was done by Mr. Jenkins, the State Gas Inspector of Massachusetts. He started with the Junkers' calorimeter, in 1896. He determined the candle powers, the heating values, and made eudio-metric analyses of the various gases, including the determination of the amounts of carbon and hydrogen in the illuminants. From the figures for the analyses he was able to figure out the calorific values of the various gases, which in almost every case coincided, within 1 or 2 per cent., of the observed measurements as determined by the calorimeter. He gave us some very good work, the results of which were published by him in his various reports for the 6 years, commencing 1896. As those reports are not now very readily accessible, I think it would be very well to collect them and publish them in permanent form, so that the members can readily refer to them.

The President—That is a very good suggestion, Mr. Hinman. Would any other gentleman like to ask Mr. Klumpp questions in regard to the calorimeter? Mr. Doherty, we would like to hear from you on this matter.

Mr. Doherty—Mr. President, I want to compliment the New England Association on giving attention to calorimetry. Personally I believe that calorimetry is of much greater importance than candle power value. In fact, we figure in some of our properties that not over 4 per cent. of our gas is concerned in candle power value; that is, there are some plants where we think 70 per cent. of the gas is used for fuel purposes, and, of the other 30 per cent., 26 is used in mantle lighting. I think that is an excellent way to show in exact figures how little the public are interested in candle power, and I know that many of us are suffering with candle power restrictions which add an unnecessary expense to us and don't bring an equivalent compensation to our customers. Mr. Klumpp brought out some data here which I believe will clear up an erroneous impression in the minds of the public and in the minds of many gas men as well. Many people believe there is a direct relation between candle power and heating value, while in truth there is no such direct relation, and we have to treat our gas, whatever it is, as the elementary gases that go to make up the whole, rather than take it as water gas or coal gas. When we stop to think of the immense variation in calorific value of the different constituent gases, with the immense variation in candle power value, and that there is no relation between the calorific value and candle power value of the constituent gases, it becomes quite apparent that there is no fixed relation between candle power and calorific value. I am sorry even to see Mr. Klumpp give as much confidence to the so-called term of net heating value as he has done. There is no such thing as net heating value, and I see no reason why we should even recognize it. The net heating value could be taken at any point, and why we should arbitrarily divide, as has been done by some writers, and take the temperature just before the condensation of water, is beyond me. I see no reason for doing it. Taking hydrogen gas, we will find that 17 per cent. of all the heating value is tied up in the form of heat of condensation; that is, we have got to reduce the products of combustion to liquid and bring them down to 60° if we are going to get anything more than 83 per cent. of the heating value of that gas. I know of no appliance that uses gas and brings the temperature simply to 212°; it is either above that or below it, and in the majority of cases it is above

it. For instance, if you will take the ordinary limit of compression on a gas engine you will find that if you could discharge your gases at the temperature which would be due to adiabatic expansion, the average gas would be discharged at some place between 1,400° and 1,600°. Every appliance has some minimum temperatures at which it exhausts its gases, and the net heating value for that gas for that particular purpose is the temperature at which that particular appliance throws it off. I have never before referred to any one of my inventions on the floor of a convention. I am going to break the rule now, for one reason. Mr. Klumpp spoke about various calorimeters, amongst them the Doherty calorimeter, and inadvertently said that that calorimeter would give net heating value when he really referred to the one calorimeter he named afterwards; but I will refer to that calorimeter simply as a matter of interest. The Junkers calorimeter I believe is the most accurate of the calorimeters that are now on the market commercially, but I think some caution should be given regarding its use, because in our experiments we have found that a green operator cannot take the same sample of gas and repeat his test with greater accuracy than 4 per cent. We also found that, depending upon the range of temperature at which you carry your water, you get some variation, due to that cause. To eliminate those errors I designed and manufactured and patented a gas calorimeter on the displacement principle, and as far as I know I hold the basic patents for all the calorimeters such as this other type of calorimeter, where the water is displaced with the gas. In my calorimeter the water, flowing through the heat absorbing chamber, displaces an equal amount of gas, which is supplied to the Bunsen burner under the absorbing chamber. In that way I use neither a gas meter nor a water meter, and I am sure of getting absolute accuracy. When Mr. Klumpp tells you that a calorimeter can be made so accurate that it is more accurate than a meter, I agree with him, and I agree that the meter is more of a source of error than the instrument itself, if the instrument is properly built. The one source or error that we are apt to have in calorimetry is to take in air having less than 100 per cent. saturation, and discharge our flue products at 100 per cent. saturation. Any gas having hydrogen or discharged gases will always have a saturation of 100 per cent., and if you take your air in having a lesser percentage of saturation that 100 per cent., some of the true heating value of your gas will have disappeared. It is also a difficult matter in any calorimeters to get your flue products at a proper temperature and discharge them at the same temperature at which you take them in. In the Junkers calorimeter you do that by the rate with which you put water through your absorbing chamber. In the calorimeter to which I referred, I did that by lessening the time contact with the heating surface by means of a short-circuited path. A little later on, and not as a matter of profit at all, I am going to try to give the gas companies a calorimeter that is accurate and give them the full advantage of the value of their gas. The Junkers calorimeter is apt to read a little bit low; that is, it does not give you the true value. It gives you a little lower value. I have been waiting until I could redesign my calorimeter with the idea of giving a calorimeter which would be more available to gas men, and would also be thoroughly foolproof. For instance, we can take our calorimeter and give a man a sample of gas thoroughly mixed, and that is the only way you can gauge the accuracy of a calorimeter itself, by working on the same sample repeatedly, and a green operator can repeat within ½ of 1 per cent. Mr. Klumpp and Prof. Burgess and Mr. Brown, by their very careful study of the Junkers calorimeter, have been able to get results that I was never able to get; but I don't think we can depend on getting those extremely accurate results in every gas works, because, very naturally, they won't give the great study and time and the intelligent thought that have been given to it by those 3 men. I think we particularly want a calorimeter that anybody can operate, and that will give us the full measure of value of our gas, so that we will lose nothing. If there is to be any error we want it in our favor, but we really want something that is absolutely accurate. That is all, Mr. President.

The President—Captain McKay, we would like to hear from you on this subject.

Captain McKay—I am sorry to be unable to give you any direct figures. If Dr. Wing is here he will give them to you.

The President—Is Dr. Wing in the room? Mr. Addicks, won't you give us a little light?

Mr. Addicks—I don't think I can give any light, but perhaps Mr. Klumpp will give us a little more light in a few directions. First, to show why the results are independent of the quantity of air used in burning the gas; that is to say, whether two, three or four times the necessary amount of air is used in the calorimeter, what the gas actually requires in the way of oxygen; secondly, how that candle power line on his diagram to the left would look if the heating value line were parallel with line No. 635, I presume it to be.

Mr. Klumpp—Referring to Mr. Addicks' first question, in operating the Junkers calorimeter we found that we could control the air by a damper at the gas outlet. Undoubtedly a large quantity of excess air goes through the calorimeter. The damper should be closed at the outlet until the flame just burns with practically complete combustion. I do not know exactly what the access air then is, possibly 100 per cent., but the most efficient results are obtained under these conditions. If the damper is opened wide an excess of air, probably 4 or 5 times, passes through the calorimeter and results are obtained from 2 to 6, in some cases 10, heat units low. I cannot say how much excess air was used under the most efficient condition. We are conducting an experiment whereby we hope to measure the quantity of air and gas in the instrument. It is going to be a pretty difficult proposition, but are quite sure we are well within 1 per cent. of the total heat that can be obtained from the gas under any conditions. Immenkoetter found, with his most efficient results, that he was getting 3 or 4 times the quantity of air when burning pure hydrogen. Regarding that candle power question, I cannot say definitely where the candle power curve would go with the heating value curve in a straight line.

Mr. Addicks—No, Mr. Klumpp excuse me; I took the lower figures, parallel to 635—the lowest point.

Mr. Klumpp—If the heating value was at 630 heat units continuously, the candle power curve would probably be inversely opposed to the heating curve. Just how many candles it would drop I can't say. It would probably be 2 candles at least, because you would then handle your oil so as to get the maximum heating value to carry.

Major Hinman—Has Mr. Klumpp experimented with saturating the supply of air for the combustion with the vapor of water; if he did do so, whether he found it was practical to operate in that way, to avoid one source of error if we could do so.

Mr. Klumpp—Mr. Chairman, as Mr. Doherty said, leaving the instrument, the exhaust gases are saturated. If the air goes in at 70 per cent. saturation and the gas goes in saturated, as it may be from a wet meter, then the quantity of air has absorbed moisture enough to saturate it from 70 to 100 per cent. Worked out theoretically it should not affect the results over 5 B.T.U.'s, and I think it is nearer 2 or 3 B.T.U.'s. In making our report last year we expressed ourselves as not satisfied that the work was finished, and we desire to find the effect of the quantity of moisture present in the gas and air and also the effect of varying quantities of air. We are to try those experiments at the University of Wisconsin, but I don't know whether we are going to get any satisfactory results. We might have to get down to a theoretical calculation, for unless every condition is absolutely reproducible it is hard to get exactly the same results. We operated 4 calorimeters side-by-side, on the same gas at the same time, and we read within ¼ of 1 per cent. Some few odd readings would vary 4 or 5 B.T.U.'s, and some 10, but we always were able to account for these discrepancies. For instance, on one calorimeter which we had, that was lagged with wood, some water was spilled over the outside of the wood and the evaporation of that water dropped the heating value of that gas as read by that calorimeter, immediately, 5 or 10 B.T.U.'s. It simply goes to show there are lots of things that are apt to interfere with investigations, and it is practically impossible to say how these various things are going to affect results.

Mr. Owens—I would like to ask if any calorimeters have been perfected for continuous operation?

Mr. Klumpp—Hugo Junkers has issued a circular for such a recording calorimeter. He uses for a calorimeter his regular type of instrument, and measures the gas and the water by two meters, gearing them together, so that the ratio of gas consumed and water passed is constant. A thermopile is then inserted in the inlet water and outlet water, which will give an electrical reading due to the difference in temperature of the water. If the gas and water are constant all that is necessary is to measure the rise in temperature of the water, which is done on a recording gauge connected to an electrical recording voltmeter which, instead of being graduated in volts, is graduated in calories direct. I have never seen the instrument.

Mr. Doherty—Mr. Chairman, may I say one word more on the calorimeter?

The President—Yes, sir.

Mr. Doherty—Somebody asked a question about saturating primary air with water vapor. I have experimented with that, and find it

makes a noticeable difference in favor of the gas company. The results I got I cannot state accurately. Mr. Klumpp said only 5 B.T.U's., but I am quite sure I have gotten above 20, and enough to make a noticeable difference to the gas company. Not only that, but Mr. Klumpp rather intimates that, after your gas has passed through a wet gas meter, you have a saturation of 100 per cent. We did not find, on actual measurements, that we had an appreciable increase in saturation after passing through a wet meter. We also found that the only apparatus that would give us complete saturation was extremely bulky; it required an enormous contact to get complete saturation. If you start in with very dry air and bring it anywhere near water it will pick up more or less water, but when you commence to saturate it the final amount then is very hard to saturate. Mr. Klumpp and his associates were working these calorimeters and were carefully regulating the amount of air going through the calorimeter, while, with the ordinary calorimeter, just turned loose, I think it showed an over-ventilation of something like 600 or 700 per cent. If you are taking 6 or 7 times as much air through your calorimeter and are taking that air in at perhaps 60 per cent. saturation and throwing it out at 100 per cent. saturation, if there is enough water there to do that, and I am quite sure there is, you will be surprised what a great difference it gives against the gas company. And so the ideal calorimeter, and we never will get anything until we have that, would be a calorimeter which worked with air saturated to 100 per cent. That will give an error slightly in favor of the gas company, yet a very small one. But to get everything to which we are entitled we ought to have air fully saturated.

Mr. Klumpp—Mr. Chairman, I said the gas going through a wet meter may be saturated. Experiments have shown that it is not always saturated. If it is going through the meter slowly the chances are that, in the presence of water, it will pick up more vapor than it had when coming from the main; but it will not necessarily be saturated. I have read of 85 and 90 per cent. saturation, but the volume of gas is so small, compared to the quantity of air, that that difference is very small.

Captain McKay—Will Mr. Klumpp express an opinion, if the best mechanical appliance were placed in the hands of the average observer, for candle power and for heat value, which would involve the smallest percentage of error?

Mr. Klumpp—I think if the average operator should operate a photometer according to the best instructions, and should operate a calorimeter according to the instructions given by the American Gas Institute Committee, and see that his water entering was at the temperature of the room, which is easily obtainable, that the calorimeter would be closer to the true result.

Captain McKay—That is not exactly what I want. Let the assumption include the average care of the ordinary, average observer, with the best mechanical appliance. For example, suppose the candle power were taken by a standardized lamp.

Mr. Klumpp—I still think the calorimeter would be closer.

Mr. Addicks—I should like to ask Mr. Klumpp if these variations, due to the extra amount of air, would have any influence at all. I understand he said that the variation there was from 2 to 10 per cent. when there was air going through. How can he regulate that?

Mr. Klumpp—I said 2 to 10 heat units, not 2 to 10 per cent.

Mr. Addicks—I understood you to say 2 to 10 per cent. I thought it was rather large.

Mr. Klumpp—Of course, I would not want the average observer to take everything as far wrong as he could on the calorimeter and everything as close to right as he could on the photometer, but if he knows that the damper should be closed as close as possible to get perfect combustion, and as he can see the flame, he can set that closer than he can set the carriage on a bar photometer.

Mr. Addicks—The variation in heat units due to the quantity of the air is 1 to 1½ per cent., then?

Mr. Klumpp—Yes; 1½ per cent, But he then would be much closer than he ever will be with a photometer, if he used candles for a standard.

Mr. Gardiner—Mr. Chairman, If I remember rightly the experiences of some years ago, where I was reading and had others reading candle powers and calorimeters, who were foremen of average intelligence and experience round the gas works, I should say that the calorimeter readings as checked by thoroughly competent operators were probably four times as accurate as the photometer readings. In other words, an operator who would make an error of 10 per cent. with the photometer would make one of but about 2½ per cent. with the calorimeter.

The President—Major Hinman, what is your experience in that line?

Major Hinman—My experience with the calorimeter is very limited indeed. I have had experience with the candles in testing gas, and found them a little more accurate than Mr. Klumpp seems to have done, but that is not the subject under discussion.

Captain McKay—Mr. President, I would like to ask another question of Mr. Klumpp and of those who seem to agree with him, in regard to the value of the calorimeter as a standard of measurement. Under the ordinary conditions of manufacture, suppose that he has worked to a B.T.U. standard, would he be able as easily and as economically in conducting the manufacture to maintain a normal of 600 B.T.U. as he would be able to work to a standard of candle power?

Mr. Klumpp—Where would you measure your gas, Capt. McKay. At the works?

Captain McKay—Wherever the testing station was placed. It is delivered heat units and delivered candle power.

Mr. Klumpp—I think, after scientifically treating the manufacture of gas, and taking the temperature of the ground and everything into consideration, that we can produce a candle power a certain distance from the works very accurately; but I also think, if we are working to a heating value standard, we could come as close with the heating value as we could with the candle power.

Captain McKay—Then, Mr. Klumpp, under those conditions, working to a standard of 600 B.T.U., you would perhaps be delivering what in summer was a 22-candle, and in the middle of winter an 18-candle. Would the consumers realize that difference?

Mr. Klumpp—The consumers, in the case Mr. Doherty speaks of, burning 4 per cent. for illuminating power, would hardly know the difference.

Captain McKay—No, I mean the ordinary consumer; I don't mean Mr. Doherty's consumer.

Mr. Klumpp—Mr. Chairman, I think that is a rather debatable question, although I don't see that the consumer now is making any complaints as regards the heating value he receives in summer or the heating value he receives in winter. His heating value varies, say, from 5 to 10 per cent. in summer and winter. He does not know the effect of that on his meter at all. If he is using gas for the same purpose, to produce the same results, then in the summer time he must be using from 5 to 10 per cent. more gas. Now, under the ordinary conditions, I don't think he would be apt to notice the variation in candle power, because now the gas is varying more for his utility purposes than it would then.

Captain McKay—Mr. Klumpp, when you say a false economy, do I understand you then to mean you would run to a candle power standard nevertheless, irrespective of the heat standard?

Mr. Klumpp—No, Mr. Chairman; I don't think that we in this country are in a condition yet to entirely give up the candle power standard, especially in our larger cities, where we supply a high candle power, because considerable gas is used for illuminating purposes with the open flame. I believe, in the majority of cases in this country, that the conditions would not change whatever, in fact, would be greater to the advantage of the consumer to shift over to a heating value basis. In cities where the gas supplied is from 22 to 25-candle power, and where many open flames are still in use for illuminating, I believe it would seriously affect those consumers who used the open flame to have the gas changed from a candle power to a heating value basis.

Captain McKay—I don't know, Mr. President, whether I have quite got what I wanted yet or not. Suppose Mr. Klumpp were free to supply gas in Philadelphia just as he pleased, would he deliver the gas to the consumer, for his own convenience, measured on candle power or measured on heat value?

Mr. Klumpp—Well, the city of Philadelphia is under contract to have a 22-candle power gas.

Captain McKay—No, irrespective of anything.

Mr. Klumpp—I think myself I would change to a heating value basis.

Mr. Addicks—Would you like to have both?

Mr. Klumpp—No; not have both. It has been tried in several places—specifications in city ordinances demanded both a heating value and a candle power requirement. Under any operating conditions it would be extremely difficult to follow, and under varying conditions, such as supplying a mixed gas, it would be impossible. In most instances one requirement could be fulfilled while the other would be defaulted. The enforcement of both seems out of all reason, and would not permit of the best gas being supplied for the least cost to the consumer.

Capt. McKay—Then. I understand, Mr. Klumpp, that under a candle power standard your consumers are satisfied.

Mr. Klumpp—I don't think any consumers are satisfied. [Laughter.]

Capt. McKay—Do you have complaints of candle power or of heat value?

Mr. Klumpp—If the consumers knew as much about the business as we do they would demand the heating value standard; but I don't think we can ever satisfy them. If they knew what was to or for their own good they would accept the heating value standard, and the burners they use in the open flame they would, where possible, convert to the mantle burner. Gentlemen, this seems to be Philadelphia against New York and Boston; but I still think Philadelphia can hold her own. [Applause.]

Captain McKay—In Massachusetts we have only the candle power standard, and the consumers are pretty well satisfied.

Mr. Kennedy—Does not the chart which is shown by Mr. Klumpp really prove what Captain McKay is trying to get at. It seems to me the candle power variation is way out of proportion, in the varying temperatures to that of the calories, and doesn't it indicate on that chart the treacherousness, in our climate, of the calorimeter? In other words, aren't you compelled, by the illustration, to go back to the photometer to guide yourself as to how you are going to economically produce your gas of definite calories?

Mr. Ramsburg—The chart which has been covered up on the board, was made, as I remember, from an asphalt base oil. The comparison between the calorific and the photogenic value of such a gas would be very different from that made from a paraffine base oil. This difference is due to the fact that, with rising ground temperatures, the amount of benzole carried by the gas is largely increased, so that with the same candle power winter and summer, at the same point of testing, the summer gas will contain more benzole than the winter. One-candle power, due to benzole, gives nearly 40 per cent. less heat than one due to the fixed oil gases, so that the heating value is a variable, the candle power being constant, during the seasons.

Mr. Barnum—What would be the relation of the two curves in the case of coal gas, not water gas?

Mr. Klummp—Mr. Chairman, I have not had the opportunity to compare as many readings on straight coal gas, but I believe that when the gas is manufactured, to get the very highest candle power, either by controlling the heats in the retorts to make the greatest amount of unfixed illuminants, or by adding these unfixed illuminants afterwards, the last few candles obtained are not increasing the heating value of the gas proportionally. A candle power lost through depositing the unfixed illuminants might mean the loss of only 10 to 15 heat units, whereas a candle power lost by the subtraction of the fixed illuminants might indicate a change of some 30 or 40 heat units.

The President - If there is nothing further on this subject we will close it, although we dislike to do it. It has become very interesting.

Mr. Addicks—Mr. President, may I move a vote of thanks to Mr. Klumpp? I don't think the number of diagrams that Mr. Klumpp has shown here begins to indicate the amount of work put into this subject, and the result of this work. I would express my gratitude as a gas engineer for the work that Mr. Klumpp and the other gentlemen have put into this calorimeter matter, which is of very great importance to the gas industry. [Seconded.]

(To be Continued.)

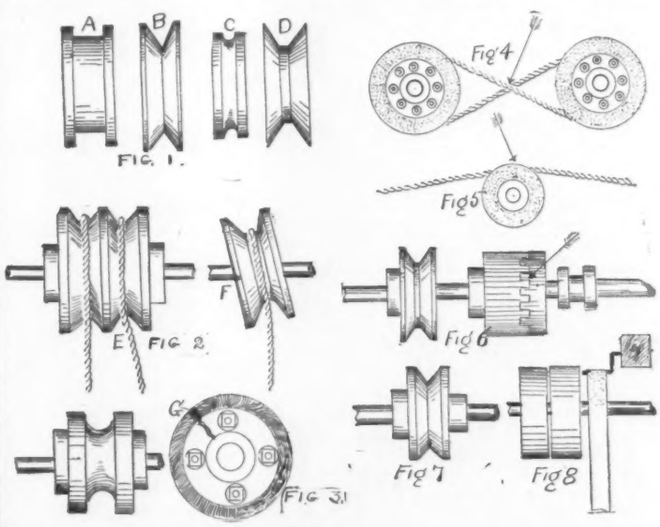
Sheaves of the Coal and Gas Plant.

[Communicated by "ENGINEER."]

An objectionable pattern of sheave is shown in Fig. 1, at *A*. This sheave was originally intended as a flanged wheel for a belt, but later was utilized to carry a rope. Owing to the wide space between the flanges, the cable had but very little opportunity to get a frictional grip on the revolving surface, and the cable slipped considerably. Finally, the wheel was removed and one, of the order shown in Fig. 1, at *B*, was substituted with a single cable. Of course, much depends upon the natnre of the service and the character of the cable, as to whether a deep-grooved, V-shaped wheel like this will do. In this special instance the cable was of cotton rope, and it was not long before the cotton fiber began wearing from it, in fact the machinery about was covered with the fuzzy felt. The cable, giving indications of wearing and becoming useless in a little time, the form of grooved sheave shown in the same cut, at *C*, was put on. Now, this sheave has its various advantages and disadvantages, as is well known to coal and gas engineers. Some systems are extant in which perfect transmission of power is obtained with a set of sheaves cut according to this rounded design; but the cable in question failed to secure a hold of proper caliber on the perfectly formed, half-round circle. A round cable, as might be expected, will slip readily on correspondingly rounded surfaces. This also is well known to the profession, but often is overlooked.

From what I have seen in some of the rope drives in coal plants and gas works, the same is often neglected. Indeed, you will find some extraordinary riggings in different works, and you will accordingly wonder why it all is, if not driven to marveling that any good at all comes from the drive. However, to return to our sheave at the point where it was once more condemned. Off came the sheave and on went one, made like *D*, same figure. Here we have something that ought to run fairly well. Almost always it does. It will be noticed that the sides are grooved and inclined, and a certain proportion is flattened. Now, then, the average cable can get a pretty good grip on this wheel. The cable will not sink too deeply between slanting sides, because the flat portion stops that. This kind of a wheel was used and, because it fitted the conditions in this special case, the wheel was maintained; but other conditions call for other patterns of wheels and varying adjustments. I found one combination built up with cumbersome wheels and extremely light ropes, as in Fig. 2. One rope was run out of line by an idler wheel, so that the rope was conveyed out of its course as at *E*. The system was incorrectly aligned. After aligning the shafts, training the sheaves and putting in some proper sized cables, we got some good from the drive.

Once I found a little cable wabbling about nobly on a bulky wheel, flat-center, as at *F*, same view. The wheel hub was worn. The latter



had to be removed and a new one substituted. Then, with the sheave straightened, a new rope of right size was put on and the drive ran correctly.

In Fig. 3 two sheaves are shown. The one at the left is of a good type, turned with side flanges and hub sleeves. A reason for making substantial flanges is found in the fact that often the light flanges crack, as at *G*, when submitted to very much strain. In a certain works I saw a cable running, as in Fig. 4, with the cables making the fiber fly. This was caused by the juncture indicated by the arrow, where the swiftly moving cables had to pass and grind one against other. We stopped the grinding by putting up an idler wheel as a guide, as in Fig. 5. This guide wheel was simply arranged so as to convey the cable outward far enough to clear the other cable.

Cables will give bother, even when the sheaves are right, if the clutches are worn or incorrectly set. Fig. 6 shows the clutch system of starting and stopping the power. I often examined for worn teeth in the clutch, and in one case found the clutch so far set out that the points of the teeth barely met. Of course, the teeth slipped and ground over each other a great deal, making a noise, besides wearing down the steel faces.

Fig. 7 portrays a good form of sheave used by some power and transmission engineers. I would let the belts hang free from the tight-and-loose pulley of the sheave-wheel system, as in Fig. 8. Here one can see that a hook is driven in a beam above the shaft, this hook being used to hold up the belt while the belt is off the pulleys. This gives the loose wheel a rest, lets the belt assume its normal shape and prevents just that much wear of the wheel hub.

[Continued from page 829.]

PROCEEDINGS, FIFTH ANNUAL MEETING, ILLINOIS GAS ASSOCIATION.

HELD IN CHICAGO, ILLS., MARCH 17TH AND 18TH, 1909.

FIRST DAY—AFTERNOON SESSION.

AN INVESTIGATION OF THE EFFECTS OF COMPRESSION AND TRANSMISSION ON THE CANDLE POWER AND HEAT UNITS OF MANUFACTURED GAS. PART II.

By MESSRS. V. A. HOUGHTON, Aurora, Ills., and S. L. COLE, Waukegan, Ills.

[For Part I. of the Paper, see JOURNAL, *ante*, p. 829.]

The purpose of this investigation is to ascertain to what extent the illuminating and calorific values of manufactured gas are affected when it is compressed and transmitted at high pressure to a distance. Separate investigations were made of coal gas and water gas, no mixture of the two being allowed during the actual time of the experiments.

The first series of tests were conducted on coal gas, tests being made on the gas immediately before and after compression and also at a point 22 miles distant via the pipe line. The size of the high pressure main between these two points is almost entirely 4 inches, and its volume is approximately 11,900 cubic feet at atmospheric pressure. Great care was exercised in purging the line and in timing the rate of flow to make sure that the same gas was tested at both points of observation. The compressors draw their supply from the town holder, thereby assuring a more uniform quality of gas. The results obtained are shown in Table I. A record was also kept of the high pressure drippage for 3 days, which is shown in Table II.

TABLE I.—*Coal Gas.*

Works.								Testing Station 22 Miles Distant.		
Holder Gas.			High Pressure Gas.							
Date 1908.	C. P.	B.T.U.	C. P.	B.T.U.	Pressure.	Temp. Gr'nd.	Temp. Air.	C. P.	B.T.U.	Av. Diff. in Pressure.
July 27.	17.8	686	17.8	705	34	59	85	16.1	635	4.0
July 28.	17.9	673	17.9	683	28	59	85	16.2	656	4.5
July 29.	17.4	669	17.8	677	25	59	83	16.6	660	6.2
July 30.	17.7	669	17.4	663	30	60	80	16.3	653	4.0
July 31.	17.3	663	17.7	665	26	59	78	16.4	643	5.9
Aug. 3.	17.8	665	17.4	675	32	59	84	16.2	634	3.8
Aug. 4.	16.6	660	17.4	679	23	60	87	16.1	641	9.5
Aug. 5.	15.5	648	16.7	665	28	59	85	15.8	637	8.0
Aug. 6.	15.1	639	14.5	639	30	60	82	14.2	631	6.1
Aug. 7.	15.9	647	15.1	648	29	60	79	15.2	633	6.3
Average	16.9	661	16.9	669	28.5	59	82	15.9	642	58

TABLE II.—*High Pressure Drippage From Coal Gas.*

Works.					Line.			
Date 1908.	Comp. Hours.	Gals. Drip.	Gals. per Comp. Hours.	Gals. per 1,000 ft. P'mp'd	1,467 ft. from Works.	3,604 ft. from Works.	4,190 ft. from Works.	5,900 ft. from Works.
August 6..	23.00	32.25	1.40	.116	6 gals.	1 qt.	1½ qts.	6 gals.
" 7..	20.00	30.75	1.53	.127	3 qts.	1 pt.	1 qt.	3 gals.
" 8..	20.75	30.25	1.45	.120	3 gals.	½ pt.	½ pt.	1 pt.

From the data obtained it was evident that there was a difference in the quality of the gas before and after compression and transmission, but the proportions of each deteriorating factor were not satisfactorily apparent. The reason for the contradictory results obtained at the works testing station, viz., the compressed gas having an equal or higher illuminating and calorific value than before compression in some cases and not in others, may be accounted for in the following manner. Since the outside temperature was in the neighborhood of 80° to 85°, when these tests were conducted, it is possible that the compressed gas upon subsequent expansion in the photometer room may have at times picked up hydrocarbon vapors from the condensate in the photometer and calorimeter leads. On the other hand the compressed gas may not have lost its vapors on the high pressure side of the regulator due to the comparatively high temperatures. The compressed gas at some point not far distant from the works was reduced to ground temperature, with a consequent loss, but the testing leads came from a point close to the compressor. Hence the compression loss was not obtained in some cases, but quite the reverse.

A second series of tests was conducted on straight water gas; three testing stations being established at 3, 8 and 18 miles from the works. These stations may be designated as A, B and C respectively. The pipe line connecting them consists of 3 inches, 4 inches and 6 inches. The first part of this series of tests was conducted between the works and B, the second between the works and C, the third between the works and A. Between parts 2 and 3 several weeks had elapsed and the weather had changed from moderately warm to cold. Circumstances had also compelled a change in the position of the apparatus at the works, the leads to the testing room being made longer in consequence; however, the usual care was taken to thoroughly purge them before testing. The results are shown in Tables III., IV. and V. A curve is also appended showing the temperatures at the outlet of the compressor for the different pressures maintained at this station during Part I of this series.

TABLE III.—*Water Gas—Between Works and Testing Station B, Transmission 8 Miles.*

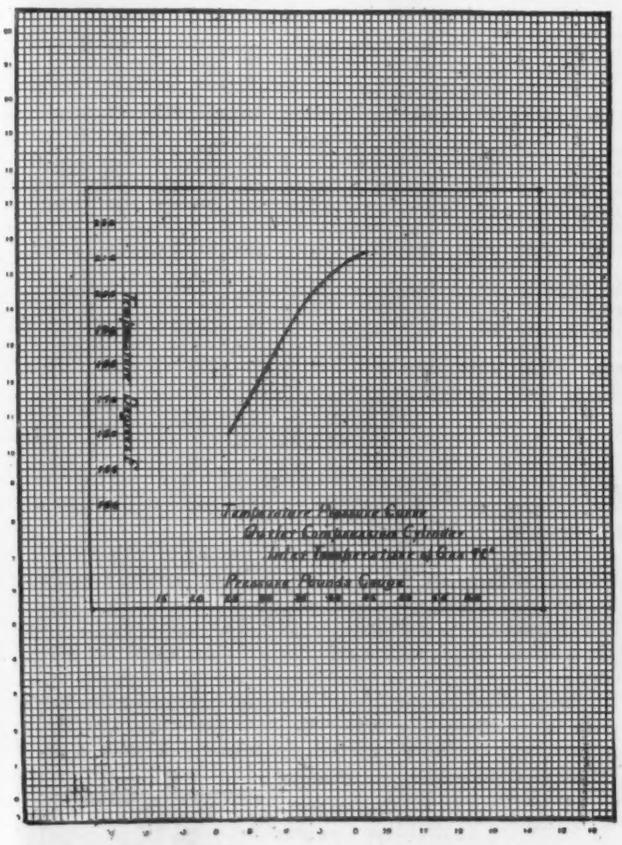
Date 1908.	Candle Power.			B.T.U.			Pressure.		
	Works.		Sta. B.	Works.		Sta. B.	Works.	Sta B.	Drop.
	Holder.	Line.		Holder.	Line.				
Sept. 16..	18.3	19.2	17.2	628.3	599.5	588.9	30	20	10
" 17..	21.0	21.0	17.4	617.4	603.3	586.7	30	21	9
" 17..	23.3	19.8	18.4	.....	.....	598.1	35	22	13
" 17.	19.8	19.3	17.7	640.6	626.5	583.0	30	22	8
" 18.	20 9	20.3	18.5	626.8	624.1	583.9	35	21	14
" 18..	19.9	21.3	19.0	624.5	612.4	584.0	30	22	8
" 19..	21.9	21.2	18.1	645.4	628.6	588.2	40	24	16
" 21..	18.4	19.8	17 7	638.3	628.9	598.8	35	22	13
" 21..	18.8	18.7	19.6	646.7	628.8	597.6	35	20	15
" 21..	18.9	18.7	19.8	639.0	641.0	602.6	30	24	6
" 22..	20.7	20.5	19.0	644.7	633.7	589.1	40	28	12
" 22..	20.1	19.8	18.9	642.2	634.5	600.8	40	23	17
" 22..	21.3	21.0	19.4	643.6	640.3	610.0	30	22	8
" 23..	21.0	20.3	18.8	643.3	631.3	589.0	30	20	10
" 23..	21.3	20.6	19.9	644.4	636.5	614.9	35	18	17
" 24..	20.6	20.3	19.4	644.5	640.1	605.9	30	20	10
" 24..	....	20.7	19.8	.	648.3	619.9	35	18	17
" 24..	20.5	20.2	19.8	654.3	654.0	610.3	30	21	9
" 25.	20.6	20.1	19.4	643.3	648.9	610.3	30	21	9
" 25..	20.8	20.2	19.7	652 0	651.7	616.7	35	19	16
" 25..	19.9	19.8	19.4	644.8	650.8	604.3	30	22	8
" 26..	19.8	19.7	17.1	636.1	628.3	600.1	40	28	12
" 26..	20.1	19.7	17.9	636.6	632.4	602.7	40	25	15
Average.	20.4	20.1	18.8	639.8	632.9	599.4	34	22	12

TABLE IV.—*Water Gas—Between Works and Testing Station A. Transmission 18 Miles.*

Date 1908.	Candle Power.			B.T.U.			Pressures.		
	Works.		Sta. C.	Works.		Sta. C.	Works.	Sta. C.	Drop.
	Holder.	Line.		Holder.	Line.				
Sept. 30. ...	20.2	19.3	17.5	612.4	609.2	613.5	30	16	14
Sept. 30.....	19.9	19.2	16.7	609.1	603.8	600.6	38	17	21
Sept. 30. ..	19.9	19.7	16.0	609.4	615.9	597.0	30	19	11
Oct. 2.....	18.8	17.3	17.2	618.1	600.6	588.3	35	19	16
Oct. 2.....	18.4	17.4	17.3	614.4	603.0	551.5	35	17	18
Oct. 2.....	19.0	18.6	17.2	615.9	610.0	560.7	30	19	11
Oct. 3.....	18.9	18.1	16.8	609.3	608.1	595.7	39	25	14
Oct. 3	18.8	18.1	17.4	626.4	617.2	585.6	39	18	21
Oct. 5.....	....	19.5	17.9	615.9	626.1	612.3	30	20	10
Oct. 5.....	20.0	10.1	17.7	625.2	620.3	580.5	35	18	17
Oct. 5... .	19.8	20.1	18.2	624.8	626.3	581.7	30	23	7
Oct. 5.....	20.0	19.1	17.7	625.2	620.3	580.5	35	18	17
Oct. 6.....	20.8	20.3	18.3	625.4	629.6	594.1	40	21	19
Oct. 6.....	....	20.5	18.4	627.8	630.4	599.5	30	22	8
Average..	19.6	19.1	17.5	618.9	616.0	587.1	34	20	14

TABLE V.—*Water Gas—Between Works and Testing Station A. Transmission 32 Miles.*

Date 1908.	Candle Power.			B T.U.		
	Works.		Station A.	Works.		Station A.
	Holder.	Line.		Holder.	Line.	
Nov. 12 ...	17.1	15.8	....	584.1	576.0	....
Nov. 12 ...	17.0	15.9	15.4	571.3	569.5	549.9
Nov. 12	17.9	14.7	15.5	559.1	560.7	548.9
Nov. 13 ...	16.7	14.8	14.4	568.7	568.0	549.7
Nov. 13	17.6	15.6	15.0	574.3	580.1	563.7
Nov. 13	17.6	15.9	14.9	573.0	592.0	561.7
Nov. 14 ..	17.2	15.1	13.9	581.7	569.1	554.1
Nov. 14 ...	17.2	15.3	14.1	585.3	580.3	556.0
Nov. 14	17.7	16.5	....	593.8	589.4	564.5
Nov. 16 ..	18.1	15 3	14.7	597.8	585.8	551.9
Nov. 16	18.8	16.4	14.9	602.2	584.8	566.9
Nov. 16 ...	19 3	16.0	15.3	617.4	588.6	572.3
Average..	17.7	15.6	14.8	584.1	578.7	558.1



It had been observed that there was little difference in the drop of candle power between the 8 and 18-mile transmission and it was determined to ascertain if the gas had dropped the greater part of its illuminants at a point nearer the works. This was the purpose of the third part of these series. At this stage of the investigation it was felt, as will be more fully explained later, that the data as obtained was not fully comparable, due to a lack of knowledge as to the degree of saturation with vapors of the low pressure gas being examined, and a final series of tests was, therefore, undertaken, in which an endeavor was made to obtain conditions as nearly comparable throughout as possible.

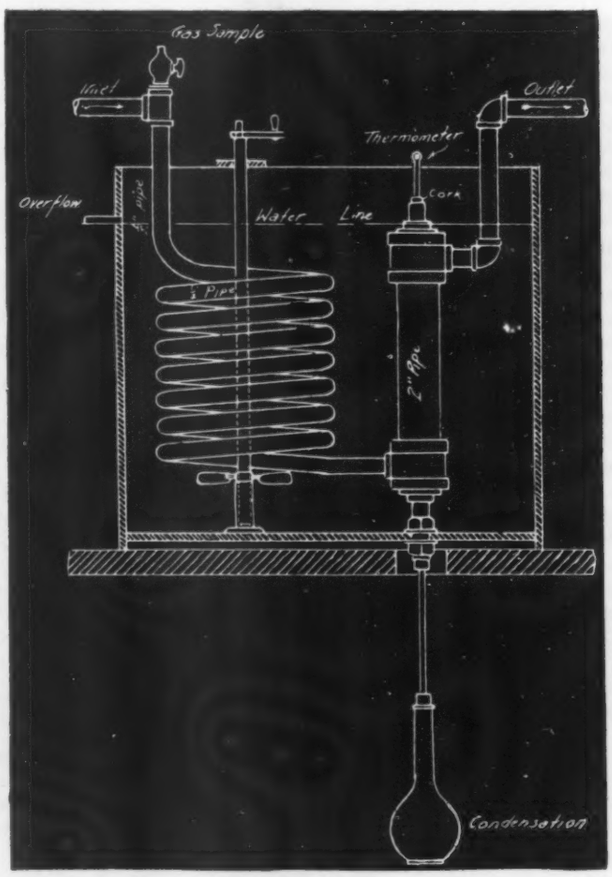
In these final tests, after operating the compressor for a sufficient length of time to make sure that a uniform sample of gas was present at both intake and outlet sides, a candle power determination was made of the low pressure gas, and at the same time a dewpoint determination was also made of the same gas, using the hygrometer described in the paper by Mr. W. H. Gartley before the Institute ("Pro." Am. Gas Inst., Vol. I., page 593), to ascertain at what minimum temperature the gas was saturated with vapors. It is understood that if gas is saturated at a certain temperature, subsequent heating will not increase the amount of vapor present, if this heating is conducted without the presence of condensed vapors.

The compressed gas was then cooled to this so-called dewpoint temperature in a cooling coil, and its candle power determined. In this manner it was possible to determine the compression effect alone. The data obtained is shown inTable VI.

TABLE VI.—*Coal Gas.*

Showing loss due to the compression alone; the high pressure gas being cooled to the dewpoint or saturation temperature of the low pressure gas. Averages of two to four tests each day.

Date 1908.	Low Pressure C. P.	Combined Dewpoint Temp. ° F.	High Pressure C. P.	Pressure Lbs. Gauge.	Temp. Photometer Room.	Temp. Outside Air.
Dec. 12.....	16.3	41	15.3	20	66	36
Dec. 14.....	16.8	44	15.1	27	67	40
Dec. 15.....	16.4	50	14.7	30	66	44



The question arose as to whether the gas should be cooled in the coil under pressure or expanded and then cooled. It was found that when the reducing regulator was placed immediately at the outlet of the compressor and before the coil, thus receiving the gas at the high temperature at which it left the compressor, there was no loss in candle power, even though the gas was subsequently cooled to the dewpoint temperature of the uncompressed gas. This seems logical because this treatment practically amounts to compression and immediate expansion, restoring the gas to its original condition as to volume and temperature. In view of this fact, the gas was cooled under pressure and then expanded before being led to the photometer. Table VII. shows results corroborating these statements.

TABLE VII.—*Coal Gas.*

Showing that with the regulator placed immediately at the outlet of the compressor and before the coil, *i. e.*, compression and immediate expansion without loss of heat, does not affect candle power.

Date 1908.	Low Pressure. C. P.	High Pressure. C.P.	Pressure. Lbs. Gauge.
Dec. 10.....	16.9	16.9	30
Dec. 11.....	14.9	14.9	26
Dec. 11.....	15.0	15.2	26

The above figures represent averages of two to four tests.

Another question also arose as to the effect, should the low pressure

gas be cooled to this dewpoint temperature. It was found, as expected, that such cooling produced no effect as shown in Table VIII.

TABLE VIII.—*Coal Gas.*

Showing the low pressure gas suffers no loss in candle power when cooled to the combined dewpoint temperature in the cooling coil.

Date, 1 08.	Low Pressure C. P. Without Coil.	Low Pressure C. P. With Coil.	Combined Dewpoint Temp.	Outside Temp.	Photometer. Room Temp.
Dec. 12.....	16.3	16.0	41	36	66
Dec. 14.....	16.8	16.9	44	40	67
Dec. 15.....	16.4	16.4	50	44	67

It was ascertained in connection with this work that the dewpoint temperature as indicated by the hygrometer was much lower for the high pressure gas cooled in the coil than for the low pressure gas. This fact agrees with the candle power loss.

A testing station was now established 3 miles distant from the works, equipped with photometer, calorimeter, hygrometer and cooling coil. All possible precautions were taken to make sure that the same gas was tested at both points. Severe weather conditions had now set in and it was found that the dewpoint temperatures at the testing station were always lower than those of the compressed and cooled gas at the works, indicating that the pipe line was subjecting the compressed gas to a lower temperature in transmission than the comparable temperature which the cooling coils were designed to effect; in other words, the compressed gas arrived at the pipe line testing station having been subjected to a lower temperature than the temperature to which it was being cooled for comparative purposes by the cooling coil at the works. Had the dewpoint temperature at the pipe line station been higher than that of the compressed gas issuing from the cooling coil at the works it would have been necessary to cool to the comparable temperature at the pipe line station in order to determine the transmission effect, if any.

As a matter of useful information the hydrocarbon dewpoint was determined in most of these later tests in addition to the combined dewpoint. That is to say, the gas was passed through calcium chloride, thereby extracting water vapor, before being passed to the hygrometer. As will be shown subsequently, the hydrocarbon dewpoint was found to be lower than the combined dewpoint in all cases, whether the gas examined was compressed or uncompressed. Table IX. shows the compression loss alone and the loss due to further cooling in the pipe line for varying conditions. The different dewpoint temperatures are also recorded.

TABLE IX.—*Coal Gas.*

Showing compression loss and loss due to further cooling in the pipe line during transmission.

Date, 1908.	Works. Low Pressure. C. P.	Works. Low Pressure. Temp. c.d.p.	Works. Low Pressure. Temp. h.d.p.	Works. High Pressure. C. P.	Works. High Pressure. Temp. c.d.p.	Works. High Pressure. Temp. h.d.p.	Works. High Pressure. P.	Testing Station 3 Miles Dis. C. P.	Testing Station 3 Miles Dis. Temperature. c.d.p.	Testing Station 3 Miles Dis. Temperature. h.d.p.	
Jan. 18..	17.1	35	—	13.7	22	—	42	12.7	15° obtainable and		
"	17.4	35	—	14.1	22	—	35	12.1	no dewpoints ob-		
"	17.3	35	—	13.7	22	—	36	12.1	servable.		
"	16.5	37	—	13.8	22	—	36				
"	16.5	37	—	13.9	23	—	37				
				13.9	23	—	38				
Average.	16.9	36—		13.9	22+		37.3	12.3			
Jan. 20..	15.0	37	24	10.9	24	18	41	10.0	9		
"	14.9	37	24	10.9	24	18	40	9.9	9	3° obtained and	
Jan. 20..	15.0	32	25	10.8	24	18	40	10.0	9	no hydrocar-	
"	15.1	32	25	10.9	24	18	41	9.1	9	bon dewpoints	
								9.1	9	reached.	
								9.2	9		
Average.	15.0	34 +	24 +	10.9	24	18	40.5	9.6	9		
One test.	B.T.U. 607.0	32	25	B.T.U. 597.3				B.T.U. 591.3			
Jan. 21..	15.3	42	32	11.4	31	25	45	10.1	8	No hydrocar-	
"	15.3	42	32	11.4	31	25	45	9.9	8	bon dewpoint	
"	15.8	48	36	11.6	35	27	37	10.2	8	obtainable.	
"	15.9	48	36	11.6	35	27	36	10.2	8		
"				11.7	35	27	35	11.1	11		
"				11.7	35	27	35	11.4	11		
Average.	15.6	45	34	11.6	34—	27—	39	10.5	9		
One test.	B.T.U. 623.9			B.T.U. 614.0				B.T.U. 600.4			
Jan. 22 .	16.4	50	35	15.5	40	33	21	14.8	17.0	6	
"	16.4	50	35	15.6	40	33	21	14.8	17.0	6	
"	15.9	47	37	15.3	40	33	23	14.1	17.5	8	
Jan. 22..	16.0	47	37	15.4	40	33	23	14.1	17.5	8	
"				15.4	40	33	24	14.1	17.5	8	
Average.	16.2	48	36	15.4	40	33	22.4	14.4	17.3	7	
One test	B.T.U. 619.2							B.T.U. 581.6			

c.d.p.—Combined dewpoint temperature.
h.d.p.—Hydrocarbon dewpoint temperature.

Lastly, a set of tests was made for candle power and dewpoint on: First, the uncompressed gas; second, the compressed gas cooled to the dewpoint temperature of the uncompressed gas; and, third, the compressed gas cooled as much as possible with salt and ice, thereby duplicating severe pipe line conditions. The results obtained are appended in Table X.

TABLE X.—*Showing the Effect of Compression and Cooling on Coal Gas.*

Date 1908.	Low Pressure. C.P.	Low Pressure. D-P. Tem. Cmbd.	Low Pressure. D-P. Tem. Hydro.	High Pressure. C.P.	High Pressure. Dewpoint Temp. Combd.	High Pressure. Dewpoint Temp. Hydro.	High Pressure. P.	High Pressure. C.P.	High Pressure. Dewpoint Temp. Combd.	High Pressure. Dewpoint Temp. Hydro.	High Pressure. P.
Jan. 26	14 6	47	32	12.7	26	17	31	9.6	19	11	32
Jan. 26	14.6	47	32	12.7	26	17	31	9.6	19	11	32
Avg..	14.6	47	32	12.7	26	17	31	9.6	19	11	32
Jan. 28	17.2	47	34	14.9	31	25	35	12.3	28	23	30
Jan. 28	17.4	47	34	15.0	31	25	35	12 3	28	23	30
Jan. 28	17.7	46	37	15.3	34	28	31	12.5	29	24	30
Jan. 28	17.7	46	37	15.2	34	28	31	12.5	29	24	29
Avg. .	17.5	46+	35+	15.1	32+	26+	33	12.4	28+	23+	30—
Jan. 29	15.3	42	30	12.4	31	26	39	11 7	29	25	35
Jan. 29	15.4	42	30	12 5	31	26	39	11.7	29	25	35
Jan. 29	15.8	43	31	12 6	31	26	39	11 8	29	25	35
Avg...	15.5	42+	30+	12.5	31	26	39	11.7	29	25	35

Coil cooled to combined dewpoint temperature of the low pressure gas.

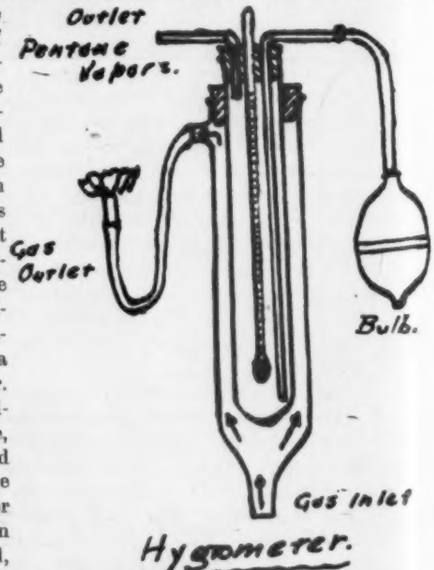
Coil cooled with salt and ice. Water vapor dewpoint alone on 1-29-4 9 found to be 12°.

A few remarks on the term dewpoint which has been used so freely may be appropriate. Dalton's laws which govern mixtures of gases and vapors are as follows:

1. The tension and consequently the quantity of vapor which saturates a given space are the same for the same temperature, whether this space contains a gas or is a vacuum.

2. The tension of a mixture of a gas and a vapor is equal to the sum of the tensions which each would exert if it occupied the same space alone.

It may be stated further, that if a gas is saturated with vapor at a certain temperature, any reduction in temperature will precipitate condensation. On the other hand, the heating of such a gas in the presence of condensate will enrich it, but if this heating is conducted without the presence of condensate the degree of saturation will not be increased. The temperature at which precipitation occurs is termed the dewpoint temperature, and if hydrocarbon vapors are present in a gas, cooling below this temperature will result in a loss of candle power. For governing the cooling coil temperature, the total or combined dewpoint temperature was used—*i. e.*, neither water nor hydrocarbon vapors were extracted, but the temperature was



utilized at which any vapor whatsoever condensed in the hygrometer. When the hydrocarbon dewpoint was determined, however, the gas was first passed through calcium chloride, thereby extracting water vapor before being passed through the hygrometer.

The hygrometer used is shown in the sketch. The gas passed around an inner tube which is cooled by means of the evaporation of a volatile liquid (pentane was used.) When the dewpoint temperature is reached precipitation of the vapors occurs on the outer surface of the inner tube. The temperature is noted with the first indication of condensation, and upon its disappearance, when the tube is allowed to warm up. The average of the two readings is considered the dewpoint temperature. It was found that with the use of the bulb for evaporating the cooling liquid difficulty was had in getting below 20° F. However, by using the gas which had passed through the instrument for evaporating purposes, 2° or 3° were readily obtainable.

Analyses of some of the condensate collected during the last series of tests are appended, showing conditions under which it was collected and various boiling points. The condensate was obtained from high pressure gas passed through the cooling coil, the temperature of the coil being maintained at the combined dewpoint temperature of the uncompressed gas.

SAMPLES OF HIGH PRESSURE CONDENSATE OBTAINED FROM 1,000 FEET OF GAS, EACH.

Sample No. 1.	Sample No. 2.
106 c. c. water or .028 gal.	141 c. c. water or .0372 gal.
159 c. c. oil or .042 gal.	124 c. c. water or .0327 gal.
265 c. c. total or .070 gal.	265 c. c. total or .0700 gal.
Pressure limits 30 to 35 lbs.	Pressure limits 26.5 to 32 lbs.
Dewpoint temperature low pressure gas 43° to 49°.	Dewpoint temperature low pressure gas 39° to 52.5°.

N. B. Gas metered through a 5-light meter.

Fractional Distillation.

Sample No. 1. Per Cent.		Temperatures C.			Sample No. 2.	Per Cent.	
21	10.5 c. c.	28°	—	80°	4 c. c.	8	No. 1
		80°	—	90°	11 c. c.	22	No. 2
76	38 c. c.	90°	—	110°	16 c. c.	32	No. 3
		110°	—	116°	7 c. c.	14	No. 4
		116°	—	150°	10 c. c.	20	No. 5
3	1.5 c. c.	Residue above 150°			2 c. c.	4	No. 6
100	50 c. c.				50 c. c.	100	

The specific gravity of fraction No. 3 was found to be 0.874 and the specific gravity of the total, without small residue fraction No. 6, was found to be 0.879.

High pressure drip oil has been tried in one of the water gas sets, producing a gas of high illuminating value. Although no candle foot tests were made of it, it was thought to be superior to naphtha, giving a brilliant white flame at the test light.

The preceding experiments have been recorded in their order as made, without much attempt to draw conclusions or afford explanations, which it should now be advantageous to summarize as well as possible. As the work proceeded the difficulty of obtaining exactly comparable data became more evident, with the constant necessity of changing the method of testing and introducing more apparatus. Errors in this apparatus, or the necessity of greater refinement of practice developed by its use, partially invalidated some of the work, causing much necessary duplication of tests and many delays.

In this connection, it may be stated that too much stress should not be laid on the results of the heat unit determinations; especially the first series, which were undertaken before the Committee Report of the Institute had laid down necessary rules of practice to avoid certain errors. The calorimetric work of the later tests, however, is deemed to be fairly trustworthy.

For the photometric work both stationary and portable bar photometers were used, the portable instrument being established in the later tests close to the compressor. Great care was taken to avoid the errors ordinarily accompanying the use of portable photometers. In the early tests both pentane and Elliott kerosene standards were used, the kerosene standard being checked with sufficient frequency against the pentane. In the later tests only pentane standards were used, carefully checked against each other.

Turning now to the tests themselves, it is clear that, in the early tests, there was no exact knowledge of the condition of the low pressure gas as to degree of saturation with vapors, and the comparison between the low pressure gas and the high pressure gas at the works is of no particular value. The comparison between the low pressure gas and the high pressure gas at distant points on the pipe line gives the total loss resulting from compression and subsequent cooling to the ground temperature, but is deficient in that the relation of this ground temperature to that to which the low pressure gas had been previously exposed is lacking. For such of these tests, however, as were made in the summer months there was probably no great difference between this low pressure saturation temperature and the ground temperature to which the high pressure gas was cooled in the pipe line, and, therefore, the results of the tests are not without value.

In the later tests it was first established to the extent that the hygrometric determination of combined dewpoint may be accepted as reliable to what temperature the low pressure gas had been exposed, that is, its temperature of saturation; and this hygrometric determination was checked by cooling the low pressure gas to this temperature and determining that by such cooling it suffered no loss in candle power. The gas was then compressed and cooled under pressure to this same temperature. The loss shown is that due to compression alone. When a gas exactly saturated with a vapor is compressed from zero to 15 lbs. gauge pressure its volume is cut in two, and it will necessarily drop ½ of this vapor, provided that there be no change in temperature. This condition of no change in temperature is the one which it was endeavored to set up in this later series of tests. When it came to making pipe line determinations it was found that the ground temperature was so low, due to weather conditions then existing, that a further cooling of compressed gas took place, with a consequent further drop in candle power, and this further drop in candle power could be duplicated by duplicating the temperature conditions in the cooling coil at the works. It is evident that there is no so-called transmission loss, but that there is a loss resulting from compression and subsequent cooling, which is dependent on the pressure to which the gas is compressed and the temperature to which it is afterwards cooled. There are further conditions, the effect of which is still indefinite, as shown by the peculiar variations in the results; namely the previous treatment of the gas and the rate of loss due to varying combinations of hydrocarbon vapors present, and the effect of these vapors and of the water vapor on one another in the total process of condensation.

In regard to the last named, the question has arisen as to whether the water vapor present has any precipitating effect on the hydrocarbon vapor. It would seem that if we have a gas for example saturated with both hydrocarbon and water vapors, say at 60°, and this gas he cooled to 40°, that, if either water or hydrocarbon vapor be artificially removed, the one remaining should precipitate at 40°. But it was found that at all temperatures the hydrocarbon vapors precipitated at a lower temperature than the combined vapors. It was also found that the water vapor dewpoint (the hydrocarbons being extracted by finely divided rubber) was much lower than either the combined or the hydrocarbon dewpoint (see Table X.) This indicates the need and possible value of careful study into the condensation of compressed gas with the view of conserving as far as possible the hydrocarbon vapors.

This work was undertaken as a part of the research contribution of our Association to the Institute and we offer it without expressing any conclusions, in the hope that it may be carried further to the final determination of the important questions raised. For the present it may, however, be said that the advantage of protecting pipe lines from exposure to low temperatures is clearly apparent and that, where maintenance of candle power is important, the advisability of very high pressures must be studied in connection with the cost of enrichment which may to some degree be necessary.

We herewith acknowledge our appreciation of the assistance rendered to us by Mr. W. H. Gartley, of Philadelphia, Pa., and Mr. E. H. Earnshaw, of Newark, N. J., for both their personal correspondence and published papers.

(To be Continued.)

Valuation of Coal Tar Pitch.

At the last annual meeting of the Manchester Section of the British Society of Chemical Industry, Mr. W. H. Coleman read a short note on this subject. Following an abstract of it in the *Chemical Trade Journal*, he referred to the lack of precision in the methods of testing at present in use, and described a method for determining the "dropping point" of pitch, which, according to the results arrived at by different experimenters, certainly showed a great improvement with regard to accuracy, and eliminated to a great extent the personal equation.

In the discussion which followed, Mr. Clayton said the present methods of testing tar products were extremely unsatisfactory, con-

sidering the large extent of their manufacture. For instance, the average briquette manufacturer bought his pitch as cheaply as possible, and then used 9 per cent. of it, irrespective of its origin, taking no account of the free carbon present. He said he should think it would be to the manufacturers' interests, when buying pitch, to adopt some method of testing it. Dr. Bailey asked if the speaker would detail some of the distillation methods of testing pitch. In replying, Mr. Coleman said one of the problems was to ascertain the amount of solid matter deposited at a definite temperature by creosote. It was possible to find this out by using creosote containing some other body, the amount of which could be easily ascertained; and he instanced tar acids. Dr. Skerrow suggested that the delegates at the Seventh International Congress of Applied Chemistry, to be held next month, should deal with the standardization of the existing methods of testing pitch. Mr. Hermann asked if it did not seem that the pitch had to be made too soft before the result could be arrived at by the new method. For instance, in testing a pitch to be used for road making, this would, in his opinion, be the only drawback to the test. Dr. Bailey questioned whether it was not possible for someone to invent a method so that the same results from the experiments might be obtained at the ordinary temperature. Replying to Dr. Bailey, Mr. Coleman said his suggestion was a good one; but as pitch when cold was extremely brittle, he was doubtful whether the tensile strength could be properly arrived at. In regard to the pitch test for road making, he felt he could rely on the results obtained by the method described.

Bureau of Information, The American Gas Institute.

Under the direction of the Institute it has been decreed: 1. That the privilege of submitting questions be limited to members of the Institute. 2. Neither the Board of Directors of this Institute, nor the Institute as a body, make themselves in any way responsible for the statements of fact or expressions of view given out by the Bureau of Information.

BUREAU OF INFORMATION, THE AMERICAN GAS INSTITUTE,
HEADQUARTERS, 1943 COMMERCIAL NATIONAL BANK BUILDING.
W. A. BAEHR, Chairman. CHICAGO, ILLS., April 26, 1909.

Addition to Addendum to Question No. 48.

THE DENVER GAS AND ELECTRIC CO.,
DENVER, COL.

Answering Question No. 48 of the Bureau of Information of the American Gas Institute, would say that, although I have worked for reasonably large sized companies, I have never had any experience with the making of meter repairs under a "Piece Work Schedule." The foreman of our shop, Mr. Lembach, has been a meter repairer for the past 18 years, and neither has he had an experience on other than day work.

Personally, I would not advocate the piece work plan on meter repairs, as I am satisfied that mechanics working under this scheme would be tempted to slight their work, and it would be a very difficult matter to check up the one at fault. It would also be necessary to penalize the men when their efforts were discovered and located.

We have about 30,000 meters installed in Denver, and aim to take out at least 10,000 every year, so that at the expiration of 3 years every one of our meters have been tested and put through the prover, which practically amounts to what we term our routine test. As stated above, our shop practice is day work.—Yours very truly, M. E. MALONE, Supt. Gas Dept.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. ELBERT HICKS, formerly in the service of the Sullivan Bros., Flushing, L. I., has been appointed to a responsible position on the New Business staff of the Consolidated Gas Company, Boston, Mass.

AT the organization meeting of the shareholders in the Cincinnati Gas and Electric Company, the following officers were named: President, Louis J. Hauck; Vice-President, S. R. Burton; Secretary-Treasurer, Theodore Clauss.

THE City Council of Uvalde, Tex., has granted a franchise to certain Cincinnati capitalists for the operation of a gas works. They are given 90 days from the date of the acceptance of the contract and franchise (the 5th inst.) to begin construction work.

ADVICES from Far Rockaway, L. I., which watering place is the headquarters of the Queens Borough Gas and Electric Company, are to the effect that Mr. Lewis B. Sharp, who has been the General Superintendent of the Company since 1897, has resigned, in order to go larger still in the real estate business, with which he has been connected for some time, latterly in connection with the well-known firm of Willett & Frost. Mr. Sharp rather favored the electric lighting end of the Far Rockaway enterprise, and has certainly worked wonders with it. With the best of good wishes for him in his new, old field, we venture the prediction that he will be back actively in the lighting industry.

THE Special Masters in Chancery, appointed to dispose of the "properties, privileges, franchises and goodwill" of the Public Service Corporation of Virginia (otherwise the owner of the Hampton and Phœbus gas plant, of Hampton, Va.) have advised that all of these rights, etc., will be disposed of by public auction, to the highest bidder, at noon of the 16th prox. The place of sale is to be at the front door of the Court House of the county of Elizabeth, city of Hampton, Va.

"T. A. B." writing from Covington, Ky., under date of the 5th inst., incloses the following: "Died in Meridian, Miss., April 30th, 1909: Mr. James Salter, in his 58th year. The subject of this notice was born in England, June 27th, 1851, and came to this country with his parents in 1854. His father (Richard Salter) now deceased, was in charge of several gas plants in this country after that date—notably, Little Rock, Ark., Evansville, Ind., and Paducah, Ky. In 1866 he took charge of the Covington (Ky.) plant, and it was at this place that the son, as assistant, began his career as a gas man. On the death of his father (September, 1891) the son was given charge as Superintendent, which position he filled with much credit to himself and benefit to his Company, until late in 1895, when, by reason of over exertion, his health became impaired, and he retired from active work. Subsequently he engaged in the lumber business, but the call of his profession was so strong that he returned to its field in 1899, in which year he became Superintendent of the Florence (Ala.) Gas Company. After the sale of the Florence plant (1904) he was called to take charge of the Meridian (Miss.) Light and Railway Company. His death was caused by an apoplectic stroke. He lived not over 30 hours from the time he was stricken, and in fact never recovered consciousness. The writer knew the deceased from his early youth, and can truthfully say that, as boy and man, he was modest, conscientious and painstaking. The plants in his charge bore evidence of his skill and energy in their vastly improved conditions, and the great betterments wrought in the Meridian plant proved that advancing years had not impaired his ability to plan and execute improvements on the properties of his Company. With truth it can be said of him that, as husband, father, brother, friend, and in his business relations as well, he was kind, loyal and true. He was laid to rest in beautiful Highland Cemetery, Covington, the 4th inst., under the auspices of, and with most impressive ceremonies, Covington Lodge, No. 109, A. F. and A. M. He rests in peace!"

MR. G. A. BECKSTEIN has been appointed Manager of the properties and business of the Sandusky (O.) Gas and Electric Company.

MR. M. E. MALONE, Superintendent of the gas division of the Denver (Col.) Gas and Electric Company, has been granted a year's leave of absence, with full pay, in the hope and belief that a long trip abroad will completely restore him to health.

THE Western Gas Construction Company is out with another of its handsome desk blotting pads. This time its makeup tends to the recalling of events well calculated to keep in mind the fervor of patriotism. Write early to Assistant Secretary Printz for a working example of same.

MR. ROYAL SHACKLETTE, Secretary of the Lloyd Construction Company, writing from Detroit, Mich., under date of the 8th inst., says: I was considerably interested in the respective statements by Mr. Ross, of Superior, Wis., and Mr. Philmer Eves, of Indianapolis, Ind., concerning the attendance at their cooking school demonstrations. All this in view of the fact that Mrs. Helen Armstrong has just concluded a course of 4 lectures in Adrian, Mich., a town of 12,000

population. In the 4 days 950 were in attendance; and this, despite the fact that on one of the days it stormed so violently that business was practically at a standstill and everyone was "rained in." It is our belief that, if it had not been for this untoward weather condition, we would have had an average of over 300 in attendance at each lecture.

A CORRESPONDENT in Taunton, Mass., incloses the following under date of the 7th inst.: "The monthly report of the city of Holyoke gas and electric supply departments for last month shows a continual falling-off in the gas output. Manager Snow finds it difficult to give a satisfactory reason for the decrease, but expresses the opinion that the condition existing will eventually correct itself. During the winter several of the large mills either changed from gas to electric light or furnished light on their own account. The electrical output, on the other hand, shows an increase that far counterbalances the shrinkage in gas output. The April output figures are as follows:

Date.	Gas Output. Cubic Feet.	Date.	Electric Output. Kw.
April, 1909.....	12,107,628	April, 1909.....	539,300
" 1908.....	12,660,939	" 1908.....	384,730
Decrease.....	553,311	Increase.....	154,570

THE International Heating and Lighting Company, Cleveland, O., which is the main party in interest in the construction of the new gas plant at Brandon, Manitoba, has awarded a contract for all the benchwork (at present 2 benches of ½ depth 6's will be constructed) to the Laclede-Christy Clay Products Company. The ironwork will be undertaken by the Kerr Murray Company. The Brandon plant will easily be at work by September 1st.

THE Petersburg (Va.) Gas Company has been purchased by the American Gas Company, of Philadelphia, through the purchase of the interests heretofore held therein by the Shelton-Apperson interests.

THE contract for the construction of the gas plant for Grinnell, Ia., has been awarded to the American Gas Construction Company, of Newton, Ia. The articles call for the completion of the building by September 1st. The Grinnell folks might better not have acted with such undue speed, since they might have by ordinary inquiry secured something in the way of gas making systems or processes that would be cheaper or more satisfactory in the long run than that which has been selected. However, time will tell; and time only, under the circumstances.

AT the annual meeting of the shareholders in the Kenton (O.) Gas and Electric Company, the officers elected were: President, M. A. Norton; Vice-President, Jos. Timmons; Secretary, Earl E. Rutledge; Treasurer and General Manager, P. M. Magley. The only change over the personnel of last year is the naming of Mr. Magley to succeed Mr. John M. Plaisted, resigned.

MESSRS. H. T. DUKE, C. J. Young and H. A. Elwell, of Philadelphia, have applied for a charter to construct and operate a gas plant in Kutztown, Pa., and the suburbs thereof. It is to be known as the Kutztown Gas Company.

So far, Mr. Searle's hat shows no signs of compressing the epidermis that covers his temple tops, and it is likely that 'tis hard work which keeps him from adding thickness to the inside and outside of his cranium. It does seem, though, that the Rochester moulders of public opinion (day and night) were trying their best to cause pufflness over and about his anatomy. As an example, here is that which the Rochester *Times*, of the 6th inst., had to say concerning him: "If all the corporation magnates were like that man Searle, what use would there ever be for a 'Big Stick?'" Really, this is too easy: "None whatever!"

MR. CHARLES STUERNWALD, Superintendent of the Citizens Gas Light Company, of South Amboy, N. J., proposes to retire from the gas business to engage in the manufacture of handkerchiefs. The factory is to be located in South Amboy.

Iron Age notes that the New York Central and Hudson River, the Pennsylvania, the New York, New Haven and Hartford and other railroads have won a victory before the Board of United States General Appraisers, it being held that steel cylinders or gasholders, used for storing illuminating gas at high pressure, may be brought into this country at the rate of 35 per cent. ad valorem under the provision in the tariff act for "tubes." While Knauth, Nachod & Kuhne, bankers and customs brokers, appear as the protestants in the legal proceedings, it is known that they represent influential railroad interests. The cylinders used for storage purposes are large affairs and are kept usually at terminal stations. From the stationary cylinders gas is transferred to the smaller tubes under the passenger cars in order to replenish the supply. According to the Government, the cylinders should be regarded as "manufactures of metal," with a tax of 45 per cent. After protracted litigation, however, the Federal courts have decided in favor of the importers. Owing to this fact, the board will now begin the determination of several hundred protests, all of which will be decided in favor of the importers. The Treasury Department will be under the necessity of making large refunds to importers, as several hundred protests are involved.

THE San Francisco Board of Supervisors, at a meeting held the 6th inst., voted to put the maximum rate at which gas can be sold in San Francisco during the next fiscal year at 85 cents per 1,000.

"J. B.," writing under date of May 6th, incloses the following: "Some days ago Peter Fair, of Redlands, Cal., secured a judgment for $625 against the Redlands Home Gas Company, which declined to connect his residence to its distributing pipes for the reason that he would not make a deposit of $10 to insure his gas account with the Company. He sued for recompense and the court awarded him $5 a day for each day he had been without gas, and an added sum to credit of liquidated damages. The judgment will be appealed.

THE Parker-Russell Company, of St. Louis, reports the following orders recently received: Refillings—At Atlanta, Ga., 6 benches of 9's, full-depth furnaces; Indianapolis, Ind., 2 through benches of 9's—retorts 20 feet; Taunton, Mass., 3 benches 6's, full-depth furnaces; Geneseo, N. Y., 1 bench 4's, open; Winston-Salem, N. C., 1 bench, half-depth 6's. At New Orleans, La, 1 arch and bench of half-depth 6's, for making oil gas; water gas linings for New Orleans, La., and Indianapolis, Ind. The Company's well put together "Instructions for handling recuperator benches" has gone into another edition. Write to the home address in St. Louis, and the Parker-Russell folks will forward a copy of it. This little tome (one can easily slip it into a fair sized pocket) has just gone into its second edition.

A CORRESPONDENT in Columbus, O., writing under date of the 8th inst., incloses the following: "The annual meeting of the shareholders of the Columbus Gas and Fuel Company, which was held early this week, were of more than ordinary interest. The routine was this: The Directors elected were Messrs. H. D. Turney, E. K. Stewart, George W. Lenks, D. E. Putnam, F. C. Hubbard and W. E. Halton. The Board organized by electing these officers: President, H. D. Turney; Vice-President, E. K. Stewart; Secretary and Treasurer, G. C. Scott. The annual report of President Turney showed the Company, after paying all operating expenses and fixed charges, etc., earned a surplus of $22,995.51 for the year, a decrease from the surplus of the fiscal year ended March 31, 1908, of $50,995.87. The reason for the loss is the decrease in revenue from the gas sales in Columbus, while the increase from cost of rentals, of production, of interest and taxes, legal expense and artificial department was $34,905, or a total of $103,504. At the close of the fiscal year the Company had under lease 61,568 acres of oil and gas lands. It gave up during the year 11,393 acres, which were deemed unproductive, and acquired in the old gas field 5,673 acres and in the Bremen oil district 10,294 acres. This makes a total addition to the holdings of the Company of 32,409 acres acquired during the year, at a cost of $15,217 in excess of the former year, and this has been charged against expenses. Thirty-five wells were completed during the year at a cost of $76,793, as against 43 wells in 1907, at a cost of $105,631.

THE old-timers of the Eastern division, of course, all will recall, Mr. Richard Coyle, who for years was works' superintendent of the Charlestown (Mass.) Gas Company, when the engineering fortunes of that Company were in the capable hands of the late Mr. George R. Neal. Well; any of them who would like to look the returns, can do so by purchasing Charlestown *Enterprise*, of the 8th inst., in which is given an excellent portrait of the veteran. Since his retirement from active work (1894) Mr. Coyle has become more enamored than ever of the beauties of Charlestown Neck, on which strip of land he has lived since 1853.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHARLES H. WADELTON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance, Single copies, 10 cents.

The JOURNAL is the official organ of the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand anytime of Wednesday.

AGENTS:

New York—American News Company, 39 and 41 Chambers street.

Germany—Lemcke & Buechner, of New York.

England—Aug. Siegle, 30 Lime street, London.

MONDAY, MAY 17, 1909.

The Market for Gas Securities.

Consolidated showed quite a bit of animation last week, and some large trading was reported in it. To-day (Friday) the opening came in at 140⅜, and by noon the bid was 143½ to 143¾. The thinking investor is evidently taking advantage of the state of the market (which, generally speaking, is inclined to weakness) to go long of Consolidated at figures reasonably well under 150. City gas bonds are firm.

Brooklyn Union also made an upward spurt, and 138½ was freely bid for it this morning. Peoples, of Chicago, gains slowly. It is asserted that the McMillin syndicate has secured control of the Laclede Gas Company, which is certainly returning to one's mutton with a vengeance. His band of financiers were those who 20-odd years ago framed up the combination at St. Louis, at which time Laclede was worth—well, just what one could get for it. Washington gas is again in the high sign list.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 17.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies,	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$73,177,000	100	143¼	143¾
Central Union Gas Co.—				
1st 5's, due 1913, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	138½	139
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	999,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1½	1¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	60	60¼
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,082,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,000,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	980,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100¼
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103¾
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	—	100
Preferred	2,500,000	100	60	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	64	64½
Preferred	25,000,000	100	93	93½
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	35,000,000	100	115½	116
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112⅜	115
General Mortgage, 5's	2,465,000	1,000	90	95
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	100	104
Washington (D. C.) Gas Co.	2,600,000	20	343¾	347½
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	230	—

Advertisers' Index.

GAS ENGINEERS. Page

Bartlett-Hayward Co., Baltimore, Md. 909
Cruse-Kemper Co., Philadelphia, Pa. 894
Davis & Farnum Mfg. Co., Waltham, Mass. 903
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Evens & Howard Firebrick Co., St. Louis, Mo. 894
Frank D. Moses, Trenton, N. J. 890
Frederick J. Mayer, New York City 889
Henry I. Lea, Chicago, Ills. 908
H. M. Byllesby & Co., Chicago, Ills. 908
Humphreys & Glasgow, New York City. 908
Improved Equipment Company, New York City. 890
Isbell-Porter Co., Newark, N. J. 896
Kerr Murray Mfg. Co., Fort Wayne, Ind. 909
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 893
Quintard Iron Works, New York City. 897
The Gas Machinery Co., Cleveland, O. 888
The United Gas Improvement Co., Philadelphia, Pa. 903
Western Gas Construction Co., Fort Wayne, Ind. 888
William A. Baehr, Chicago, Ills. 886

GAS WORKS APPARATUS AND CONSTRUCTION.

Bartlett-Hayward Co., Baltimore, Md. 909
Chamber Oven Co., Milwaukee, Wis. 891
Connelly Iron Sponge & Governor Co., New York City. 905
Continental Iron Works, Brooklyn, N. Y. 906
Cruse-Kemper Co., Philadelphia, Pa. 894
Davis & Farnum Mfg. Co., Waltham, Mass. 903
Deily & Fowler Mfg. Co., Philadelphia, Pa. 912
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Evens & Howard Firebrick Co., St. Louis, Mo. 894
Gas Engineering Co., Trenton, N. J. 890
Humphreys & Glasgow, New York City. 908
Improved Equipment Company, New York City. 890
Isbell-Porter Co., New York City. 816
Kerr Murray Mfg. Co., Fort Wayne, Ind. 909
Lloyd Construction Co., Detroit, Mich. 898
Quintard Iron Works Co., New York City. 897
R. D. Wood & Co., Philadelphia, Pa. 910
Riter-Conley Mfg. Co., Pittsburgh, Pa. 895
Stacey Mfg. Co., Cincinnati, O. 911
The Gas Machinery Co., Cleveland, O. 888
The United Gas Improvement Co., Philadelphia, Pa. 903
Western Gas Construction Co., Fort Wayne, Ind. 888

PROCESSES.

Bartlett-Hayward Co., Baltimore, Md. 909
Chamber Oven Co., Milwaukee, Wis. 891
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Humphreys & Glasgow, New York City. 908
Improved Equipment Company, New York City. 890
The Gas Machinery Co., Cleveland, O. 888
The United Gas Improvement Co., Philadelphia, Pa. 903
Western Gas Construction Co., Fort Wayne, Ind. 888

SCRUBBERS AND CONDENSERS.

Bartlett-Hayward Co., Baltimore, Md. 909
Continental Iron Works, Brooklyn, N. Y. 906
Cruse-Kemper Co., Philadelphia, Pa. 894
Davis & Farnum Mfg. Co., Waltham, Mass. 903
Economical Gas Apparatus Construc. Co. Toronto, Ont. 886
Evens & Howard Firebrick Co., St. Louis, Mo. 894
Isbell-Porter Co., Newark, N. J. 896
Kerr Murray Mfg. Co., Fort Wayne, Ind. 909
Quintard Iron Works, New York City. 897
R. D. Wood & Co., Philadelphia, Pa. 910
Riter-Conley Mfg. Co., Pittsburgh, Pa. 895
Stacey Mfg. Co., Cincinnati, O. 911
The Gas Machinery Co., Cleveland, O. 888
The United Gas Improvement Co., Philadelphia, Pa. 903
Western Gas Construction Co., Fort Wayne, Ind. 888

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
R. D. Wood & Co., Philadelphia, Pa. 910

TAR AND CARBONIC ACID EXTRACTOR.

Bartlett-Hayward Co., Baltimore, Md. 909
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Isbell-Porter Co., Newark, N. J. 896
Kerr Murray Mfg. Co., Fort Wayne, Ind. 909
Stacey Mfg. Co., Cincinnati, O. 911
The Gas Machinery Co., Cleveland, O. 888
The United Gas Improvement Co., Philadelphia, Pa. 903
Western Gas Construction Co., Fort Wayne, Ind. 888

AMMONIA CONCENTRATORS.

Bartlett-Hayward Co., Baltimore, Md. 909
Michigan Ammonia Works, Detroit, Mich. 886
The Gas Machinery Co., Cleveland, O. 888
Western Gas Construction Co., Fort Wayne, Ind. 888

GAS METERS.

American Meter Co., New York and Philadelphia..... 915
D. McDonald & Co., Albany, N. Y..... 913
Helme & McIlhenny, Philadelphia, Pa..... 915
John J. Griffin & Co., Philadelphia, Pa..... 916
Keystone Meter Co., Royersford, Pa..... 914
Maryland Meter and Mfg. Co., Baltimore, Md..... 914
Metric Metal Co., Erie, Pa..... 915
Nathaniel Tufts Meter Co., Boston, Mass..... 914
New York Improved Meter Co., New York City..... 914
Pittsburg Meter Co., East Pittsburg, Pa..... 898
Rotary Meter Co., New York City..... 887
Sprague Meter Co., Bridgeport, Conn..... 913
United States Meter Co., Brooklyn, N. Y..... 915

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 915
D. McDonald & Co., Albany, N. Y..... 913
Helme & McIlhenny, Philadelphia, Pa..... 915
John J. Griffin & Co., Philadelphia, Pa..... 916
Keystone Meter Co., Royersford, Pa..... 914
Nathaniel Tufts Meter Co., Boston, Mass..... 914
New York Improved Meter Co. New York City..... 914
Pittsburg Meter Co., East Pittsburg, Pa..... 898
Sprague Meter Co., Bridgeport, Conn..... 913

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City..... 914

WATER METERS.

Pittsburg Meter Co., East Pittsburg, Pa..... 898

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Donaldson Iron Co., Emaus, Pa..... 900
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
R. D. Wood & Co., Philadelphia, Pa..... 910

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 906
Perkins Co., New York City..... 906
Westmoreland Gas Coal Co., Philadelphia, Pa..... 907

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City..... 907

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 907

GAS TAPPING MACHINES.

George Light, Dayton, O..... 907
H. Mueller Manufacturing Co. Decatur, Ills..... 886

CANNEL COALS.

Perkins & Co., New York City..... 906

STOKING MACHINERY.

G. A. Bronder, New York City..... 905
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 893

CONVEYORS—ALL KINDS.

Bartlett-Hayward Co., Baltimore, Md..... 909
Brown Hoisting Machinery Co., Cleveland, O..... 900
Cruse-Kemper Co., Philadelphia, Pa..... 896
C. W. Hunt Company, New York City..... 908
Economical Gas Apparatus Construc. Co., Toronto, Ont. 883
G. A. Bronder, New York City..... 905
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
The Gas Machinery Co., Cleveland, O..... 888
Western Gas Construction Co., Fort Wayne, Ind..... 868

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
Stacey Mfg. Co., Cincinnati, O..... 911

GAS ENRICHERS.

Standard Oil Co., New York City..... 859

COKE CRUSHERS.

Bartlett-Hayward Co., Baltimore, Md..... 909
C. M. Keller, Columbus, Ind..... 907

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 886

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 886

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 900

GAS GOVERNORS.

Chaplin-Fulton Mfg. Co., Pittsburg, Pa..... 910
Connelly Iron Sponge & Governor Co., New York City. 905
Evens & Howard Firebrick Co., St. Louis, Mo..... 894
Isbell-Porter Co., Newark, N. J..... 896
Pittsburg Meter Co., East Pittsburg, Pa..... 898
R. D. Wood & Co., Philadelphia, Pa..... 910
Reynolds Gas Regulator Co., Anderson, Ind..... 907

CEMENTS.

C. L. Gerould, New Castle, Pa..... 904
Strassburger Bros., Chicago, Ills..... 904

RETORTS AND FIREBRICKS.

Baltimore Retort and Firebrick Co., Baltimore, Md... 904
Chamber Oven Co., Milwaukee, Wis..... 891
Didier-March Co., New York City..... 889
Evens & Howard Firebrick Co., St. Louis, Mo..... 894
Gas Bench Construction Co., St. Louis, Mo..... 897
Henry Maurer & Son, New York City..... 897
Improved Equipment Company, New York City..... 890
James Gardner, Jr., Co., Bolivar, Pa..... 906
J. H. Gautier & Co., Jersey City, N. J..... 904
Laclede-Christy Clay Products Co., St. Louis, Mo..... 904
Missouri Firebrick Co., St. Louis, Mo..... 904
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 893

INCLINED RETORTS.

Baltimore Retort and Firebrick Co., Baltimore, Md... 904
Didier-March Co., New York City..... 889
Gas Bench Construction Co., St. Louis, Mo..... 897
Improved Equipment Company, New York City..... 890
Laclede-Christy Clay Products Co., St. Louis, Mo..... 904
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 893

VERTICAL S'S.

Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 905
Didier-March Co., New York City..... 889
Gas Bench Construction Co., St. Louis, Mo..... 897
Improved Equipment Company, New York City..... 890
Laclede-Christy Clay Products Co., St. Louis, Mo..... 904
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 893

REGENERATIVE FURNACES.

Baltimore Retort and Firebrick Co., Baltimore, Md.. 904
Bartlett, Hayward & Co., Baltimore, Md..... 909
Didier-March Co., New York City..... 889
Gas Bench Construction Co., St. Louis, Mo..... 897
Improved Equipment Company, New York City..... 890
J. H. Gautier & Co., Jersey City, N. J..... 904
Missouri Firebrick Co., St. Louis, Mo..... 104
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 893

SELF-SEALING MOUTHPIECE DOORS.

Bartlett-Hayward Co., Baltimore, Md..... 909
Continental Iron Works, Brooklyn, N. Y..... 910
Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Isbell-Porter Co., Newark, N. J..... 896
Improved Equipment Company, New York City..... 890
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 893
Quintard Iron Works, New York City..... 947
R. D. Wood & Co., Philadelphia, Pa..... 910
Stacey Mfg. Co., Cincinnati, O..... 911
The Gas Machinery Co., Cleveland, O..... 888
Western Gas Construction Co., Fort Wayne, Ind..... 868

INCANDESCENT GAS LAMPS.

General Gas Light Co., Kalamazoo, Mich..... 892
Welsbach Company, Gloucester, N. J..... 902

BURNERS.

Wm. M. Crane Co., New York City..... 892

STREET LAMPS.

Thos. T. W. Miner, New York City..... 898
Welsbach Street Lighting Co., New York and Phila.. 902

PURIFIERS.

Bartlett-Hayward & Co., Baltimore, Md..... 909
Connelly Iron Sponge & Governor Co., New York City. 905
Cruse-Kemper Co., Philadelphia, Pa..... 896
Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Isbell-Porter Co., Newark, N. J..... 896
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
Quintard Iron Works, New York City..... 897
R. D. Wood & Co., Philadelphia, Pa..... 910
Stacey Mfg. Co., Cincinnati, O..... 911
The United Gas Improvement Co., Philadelphia, Pa... 103
Western Gas Construction Co., Fort Wayne, Ind..... 868

VALVES.

Bartlett-Hayward & Co., Baltimore, Md..... 909
Continental Iron Works, Brooklin, N. Y..... 106
Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Isbell-Porter Co., Newark, N. J..... 896
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 109
Ludlow Valve Manufacturing Co., Troy, N. Y..... 908
R. D. Wood & Co., Philadelphia, Pa..... 910
Stacey Mfg. Co., Cincinnati, O..... 911
The Gas Machinery Co., Cleveland, O..... 888
The P. H. & F. M. Roots Co., Connersville, Ind..... 899
Western Gas Construction Co., Fort Wayne, Ind..... 868

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City 905
F. Behrend, New York City..... 908
The United Gas Improvement Co., Philadelphia, Pa... 903

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City 905
Connersville Blower Company, Connersville, Ind..... 912
Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Isbell-Porter Company, Newark, N. J..... 896
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
Piqua Blower Co., Piqua, O..... 897
The P. H. & F. M. Roots Co., Connersville, Ind..... 859

(Continued on page 886.)

Position Wanted
As Superintendent,

By a competent gas man who has had practical experience in all branches of the business, both coal and water gas. At present employed. A-1 references.

1755-tf Address, "R. C.," care this Journal.

Position Wanted.

On or before May 1st I shall be open for a position as superintendent or manager of a gas or electric property or of a combined property. I am a graduate of a leading technical university and have had 6 years of actual operation in the above lines. I am obliged to look for a position because of a complete change in the management of the companies I am now employed with as assistant to the president. I can refer directly to him as one of my references, and also to several leading gas and electrical engineers as to my ability and character. I am 29 years of age. Address reply to "M.,"

1766-tf Care this Journal.

MANAGER WANTED.

Wanted at once, experienced, competent, energetic, practical man, to take charge of New Business Department of Gas Company, adjacent New York City. Splendid opening and good salary paid to one who can show results. Address, giving full particulars regarding former employment.

GEORGE MacDONALD,
1770-4 144 Broadway, N. Y. City.

WANTED,

For Western territory, an aggressive and competent traveling salesman for a leading line of gas ranges and heaters. State age and experience.

Address, "MANUFACTURER,"
1767-tf Care this Journal.

GAS SOLICITOR WANTED.

Some one to secure new business in appliances and lighting. New field and attractive proposition for suitable man. New England location.

Address, "C. V. R.,"
1770-2 Care this Journal.

WANTED,
Meter Testers and Repairers.

Six meter repairers and two meter testers, in a Missouri city, at once. State experience. Will pay $2.50 per day, or piece work.

1771-1 Address, "METER 716," care this Journal.

GAS SOLICITOR WANTED.

Experienced man who is a hustler and can show results. State experience, salary wanted, etc.

SAULT STE. MARIE GAS & ELECTRIC CO.,
1771-2 SAULT STE. MARIE, MICH.

COAL TAR FOR SALE.

Two hundred barrels of coal gas tar for sale at a bargain if taken at once. Cheap boat freight rates to all lake ports. Write SAULT STE. MARIE GAS AND ELECTRIC COMPANY, Sault Ste. Marie, Mich., for prices.

1771-2

FOR SALE,

One set of 4 purifying boxes 12 feet 8 inches by 10 feet 9 inches by 3 feet, in good condition, with centerseal and 10-inch connections. Also one American 8-foot station meter.

1771-tf YORK GAS CO., York, Pa.

FOR SALE OR ON ROYALTY BASIS.

The advertiser offers for sale patent rights on a valuable improvement in the construction of gas meters, or will treat on a royalty basis.

1771-1 Address, "PATENTEE," care this Journal.

(Concluded from page 885.)

HIGH PRESSURE GAS GOODS.

H. Mueller Manufacturing Co., Decatur, Ills..... 886

PURIFIER AND SCRUBBER TRAYS.

Bartlett-Hayward Co., Baltimore, Md..... 909
Cabot Mfg. Co., Hoboken, N. J..... 909
Western Gas Construction Co., Fort Wayne, Ind..... 868

PIPE LINE TOOLS.

H. Mueller Manufacturing Co., Decatur, Ills..... 886

GAS PLANT TOOLS.

H. Mueller Manufacturing Co., Decatur, Ills..... 886

GAS STOVES.

American Meter Co., New York and Philadelphia..... 901
Keystone Meter Co., Royersford, Pa..... 914
Maryland Meter & Manufacturing Co., Baltimore, Md... 914
Nathaniel Tufts Meter Co., Boston, Mass..... 914

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 898

GASHOLDERS.

Bartlett-Hayward Co., Baltimore, Md. 909
Continental Iron Works, Brooklyn, N. Y..... 906
Cruse-Kemper Co., Philadelphia, Pa..... 896
Davis & Farnum Mfg. Co., Waltham, Mass..... 898
Deily & Fowler Mfg. Co., Philadelphia, Pa..... 912
Economical Gas Apparatus Construc. Co., Toronto, Ont. 886
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 909
R. D. Wood & Co., Philadelphia, Pa..... 910
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 896
Stacey Mfg. Co., Cincinnati, O..... 911
Western Gas Construction Co., Fort Wayne, Ind..... 868

STORAGE TANKS.

Bartlett-Hayward Co., Baltimore, Md..... 909
Davis & Farnum Mfg. Co., Waltham, Mass..... 908
Quintard Iron Works, New York City..... 897
Stacey Mfg. Co., Cincinnati, O..... 911
Western Gas Construction Co., Fort Wayne, Ind..... 868

PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 907

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

WILLIAM A. BAEHR,
Consulting Engineer,
Representing
BARTLETT-HAYWARD CO.,
1943 Commercial National Bank Bldg.,
CHICAGO.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants.
PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.
AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

Gas Engineer's Pocket-book, — BY — HENRY O'CONNOR,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by AMERICAN GAS LIGHT JOURNAL, - 42 Pine St. N. Y. City.

Mueller Extra Heavy High Pressure Gas Service Cocks.

Just as it is necessary to build a seagoing vessel big and strong compared to a river steamboat, it is necessary to make high pressure gas cocks heavy and strong as compared to low pressure cocks.

In Mueller Extra Heavy High Pressure Gas Cocks this demand for resistance is met by walls of extra thickness and especially heavy ends which are not cored out under the hexes.

These cocks have solid keys drilled 3/8, 3/16 and 1/4 inch at the bottom of the body opening. Hole will be drilled at any point desired. Every cock thoroughly tested.

Unconditionally Guaranteed.

TEE HANDLE CURB COCK.

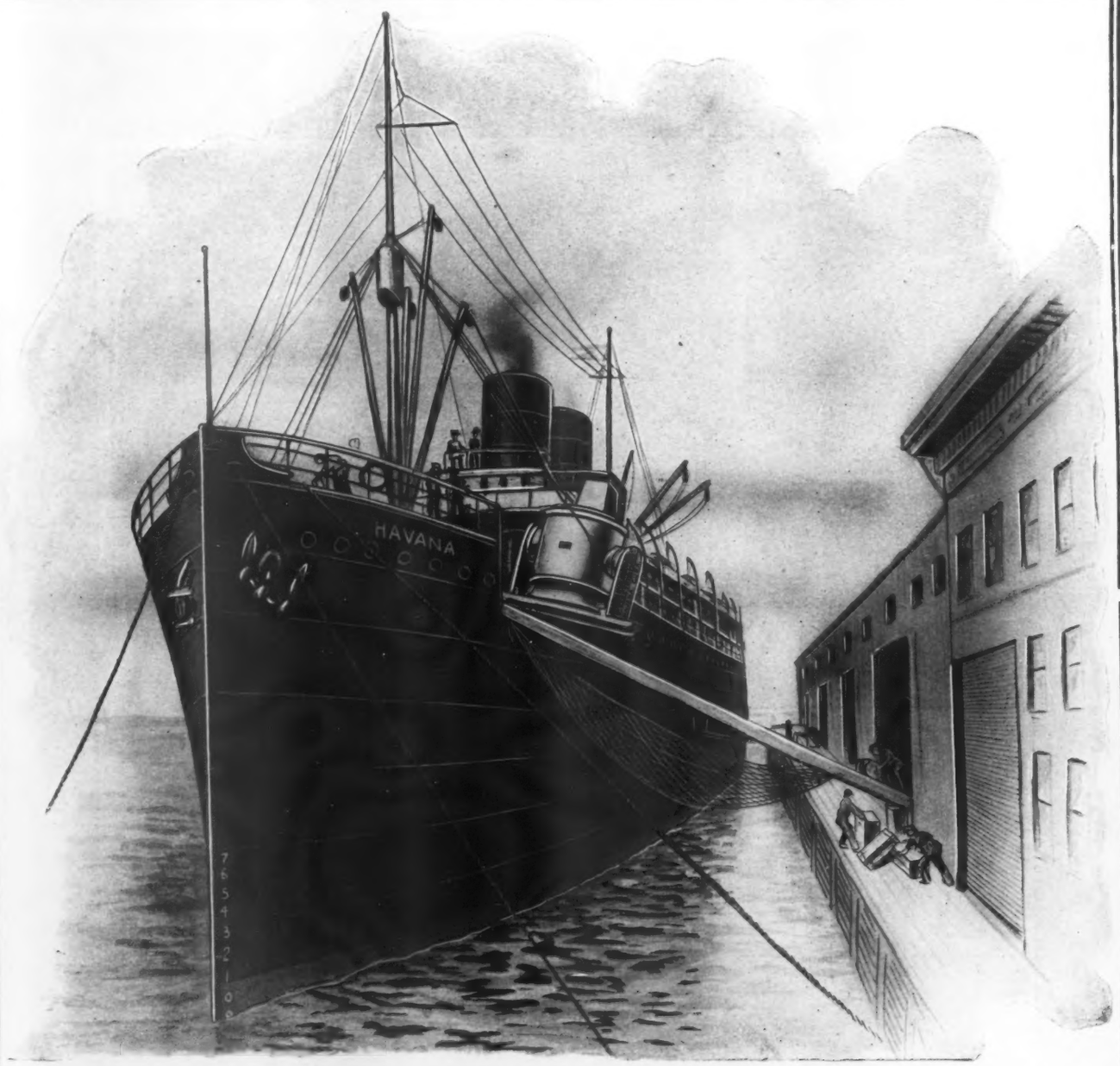
D-21051.

TRADE MARK MUELLER REGISTERED

H. MUELLER MFG. CO.

Works and General Offices, DECATUR, ILL., U. S. A. West Cerro Gordo St.
Eastern Division, NEW YORK, N. Y., U. S. A. 254 Canal St. (cor. Lafayette).
Chicago Branch, CHICAGO, ILL., U. S. A. 37 Dearborn St.

Newbigging's Handbook for Gas Engineers and Managers.
PRICE, $6.50.
AMERICAN GAS LIGHT JOURNAL, - 42 Pine Street, New York City.



Scene on Ward S. S. Line Pier, New York, when a 250,000 cu. ft. per hour

ROTARY STATION METER

was loaded on board S. S. Havana for delivery to **Compania de Gaz y Electricidad, Habana, Cuba.** We can ship by water and rail—freight or express—it's all the same to us so long as the customer gets the goods.

It is time to stop "guessing"—some dignify it by calling it "estimating"—the results obtained in a gas works. Put in a Rotary Station Meter and know what is doing. Rotary Meters are annually saving their cost in scores of gas works.

Rotary Station Meters can be supplied for any capacity between 1,500 cu. ft. per hour and 250,000, or more, cu. ft. per hour.

One-half the Cost—One-tenth the Space of Old Style Wet Meters.

When in need of Station Meters write

ROTARY METER COMPANY

Send for Catalog. **280 Broadway, NEW YORK.**

P. PLANTINGA, President W. E. STEINWEDELL, Secretary

THE GAS MACHINERY CO.,

Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - 56 PINE STREET.

COAL AND WATER GAS APPARATUS,
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS; WASHERS, PURIFIERS,
VALVES, CONNECTIONS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.

ROUND STEEL PURIFIERS WITH GATE AND DOUBLE SEATED REVERSING VALVE CONNECTIONS.

THE GAS MACHINERY CO.
CLEVELAND, OHIO.

DIDIER-MARCH COMPANY,

Hudson Terminal Building,

WORKS:
Keasbey, Perth Amboy, N. J.

50 Church Street,
NEW YORK, N. Y.

DESSAU SYSTEM OF VERTICAL RETORTS,

"The Only System in Successful Operation."

U. S. Patent No. 904043.
"Process Patent for the Carbonization of Coal in Vertical Retorts."

U. S. Patent No. 801268.
"Operating Mechanism for Bottom Mouthpieces."

U. S. Patent No. 906187.
"Feeding Device."

U. S. Patent No. 899503.
"Retort House."

U. S. Patent No. 915156.
"Recuperation."

388 Benches, with 3984 Retorts in operation and under construction.

TOTAL DAILY PRODUCING CAPACITY, 60,000,000 CUBIC FEET.

First Installation in the United States of America,

PROVIDENCE, R. I., 12 BENCHES, 120 RETORTS,

Complete, with

Retort House, Coal and Coke Handling Machinery and Storage Bins.

HORIZONTALS AND INCLINES OF APPROVED TYPES.

Correspondence Solicited. **FREDERICK J. MAYER, General Manager.**

WE STOP CLINKERS.

Send for Bulletin.

INSTALLATIONS MADE AND UNDER CONSTRUCTION IN THIRTEEN STATES FROM THE ATLANTIC TO THE PACIFIC.

NO CONDITION TOO EXACTING FOR US TO MEET AND SHOW INCREASED CARBONIZING CAPACITY, SAVING IN BENCH FUEL, SAVING IN LABOR, INCREASED LIFE OF BENCH AND ABSOLUTE ELIMINATION OF CLINKERS.

FIVE BENCHES EQUIPPED WITH ECONOMIZER UNDER CONSTRUCTION.

THE IMPROVED EQUIPMENT COMPANY,

MAIN OFFICES: 60 WALL STREET, NEW YORK, N. Y.

SOLE LICENSEES FOR THE DOHERTY BENCH FUEL ECONOMIZER.

LONG DISTANCE TELEPHONE, 1503-D. FRANK D. MOSES, President.

GAS ENGINEERING CO.,

MANUFACTURERS AND ERECTORS OF

COMPLETE GAS WORKS.

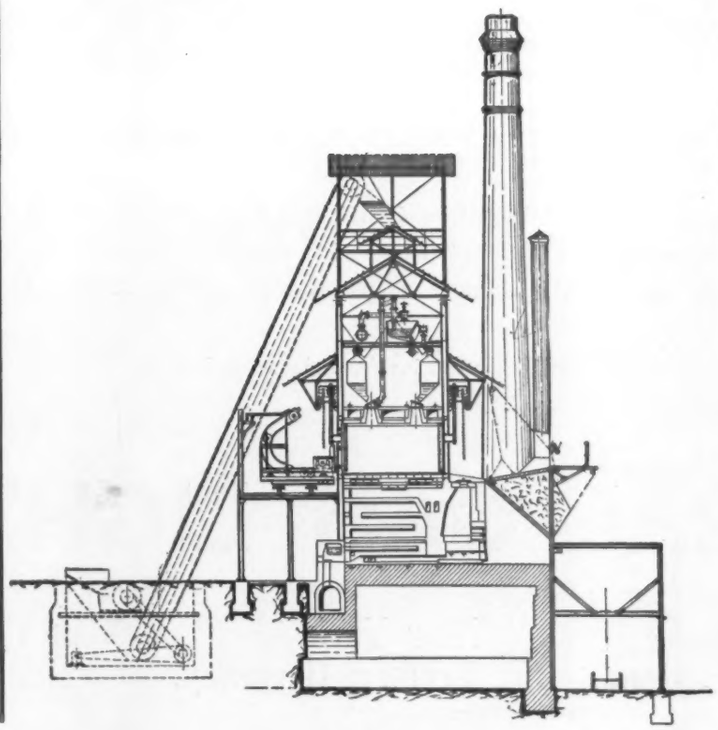
SPECIAL ATTENTION GIVEN TO LARGE PURIFIERS.

OFFICE AND WORKS, - - - - - - TRENTON, N. J.

CHAMBER OVENS.

Do You Know About Chamber Ovens?

Horizontal, Vertical, or Inclined.



If your output is over 250,000 feet per diem don't fail to consult

THE CHAMBER OVEN CO.,

405 Keene St.,

MILWAUKEE, WIS.

FRED. BREDEL, President.

WM. H. CAMPBELL, Eastern Agent,

Virginia State Insurance Building, Richmond, Va.

PRACTICAL HANDBOOK ON

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author, GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

JUST PUBLISHED,

CHEMISTRY OF GAS MANUFACTURE,

By HAROLD M. ROYLE, F.C.S.,

Chief Chemical Assistant at the Beckton Gas Works.

A PRACTICAL MANUAL FOR GAS ENGINEERS, GAS MANAGERS AND STUDENTS.

316 PAGES, 82 ENGRAVINGS AND COLORED PLATES.

Chapter I. Preparation of Standard Solutions. II. Coal. III. Furnaces, Testing and Regulation. IV. Products of Carbonization. V. Analysis of Crude Coal Gas. VI Analysis of Lime. VII. Ammonia. VIII. Analysis of Oxide of Iron. IX. Naphthaline. X. Analyses of Firebricks and Fireclay. XI. Photometry and Gas Testing. XII. Carburetted Water Gas. Appendix A. Metropolis Gas. B. Miscellaneous Extracts. C. Useful Tables, etc.

Price, $4.50. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

THE HUMPHREY GAS ARC LAMP,

Designed, Developed and Distinguished as

"THE GAS COMPANY'S LAMP,"

Has been one of the most conspicuous successes of the past decade in lighting lines. The competing lamps that were brought out in scores during the earlier days had but a brief life and exist to-day principally as unpleasant memories of ill-considered purchases. **Is not the same thing about to be repeated with Inverted Gas Arc Lamps?**

Adopt the **Humphrey Inverted** as your standard and be insured and protected by the strongest, most liberal and progressive gas lighting organization in the world.

GENERAL GAS LIGHT CO.,

Kalamazoo. **New York.** **San Francisco.**
London, England. **Bremen, Germany.** **Wellington, New Zealand.**

IT IS ABSOLUTELY NECESSARY

that people be reminded continually that you are ready to sell them the things they want. This is a big world, with lots of people in it, and you are easily forgotten if you don't keep buyers posted. What you should do is to tell them about your product to-day, remind them to-morrow, and keep on reminding them thereafter. If you do this, when the buyer is ready to place his order he will remember you. :: :: :: :: :: :: :: :: :: ::

An Advertisement in the AMERICAN GAS LIGHT JOURNAL

is the best and surest means of keeping your name and product before the buyers. :: ::

THE PARKER-RUSSELL MINING AND MFG. CO.,

Saint Louis, Missouri. **New York Office, 45 Broadway.**

Retort Benches of Every Description, Water Gas Linings, Retort Houses, Conveying Machinery.

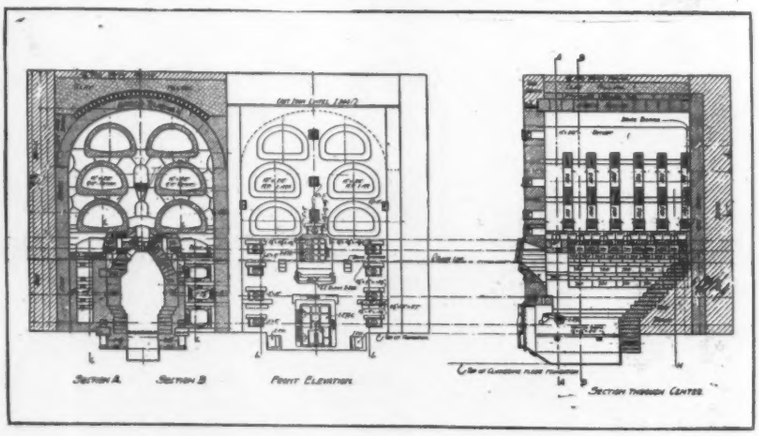
Fiddes-Aldridge One Stroke Stoking Machine.

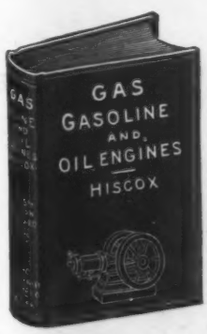
Note Strength of Construction of Half-Depth Bench of Sixes.

We not only Design and Construct Benches, but Manufacture our own Retorts and other Fire Clay Materials, and are independent of other manufacturers.

Correspondence Solicited.

All Contracts Made as of Saint Louis.





JUST PUBLISHED, 15TH EDITION, REVISED, ENLARGED AND RESET.

Gas, Gasoline and Oil Engines,

INCLUDING GAS PRODUCER PLANTS,

By GARDNER D. HISCOX, M.E.

Author of "MECHANICAL MOVEMENTS," "COMPRESSED AIR," Etc.

PRICE, - - - - - $2.50.

The only complete American book on the subject for Gas Engine Owners, Gas Engineers and intending purchasers of gas engines, treating fully on the construction, installation, operation and maintenance of gas, gasoline, kerosene and crude petroleum engines.

The new rewritten, enlarged and revised 15th edition of this work has been prepared to meet the increasing demand for a thorough treatise on the subject. Its 450 pages give general information for everyone interested in this popular motive power and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer. It is fully illustrated by 351 Engravings and Diagrams. For sale by

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.

Gas Companies' Bookkeeping,

1906 EDITION,

By JOHN H. BREARLEY and BENJAMIN TAYLOR.

A Practical Treatise on the Keeping of Gas Companies' Accounts,

WITH USEFUL

FORMS FOR GAS UNDERTAKINGS.

PRICE, CLOTH, $4.50, MOROCCO, $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - - 42 Pine Street, New York City.

EVENS & HOWARD FIRE BRICK CO

RETORT CONTRACTORS—MODERN METHODS.

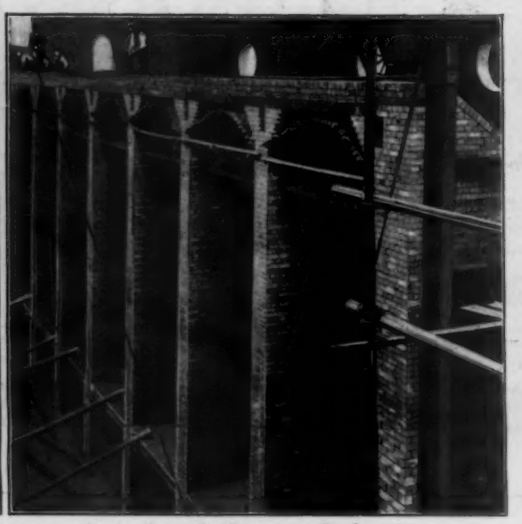
Temporary unloading contrivances save time and cost of erection.

We generally erect at one time ironwork for one stack and brickwork for another in the same building. It saves time.

"STAR" RETORTS AND BENCHES. HORIZONTAL. INCLINED. VERTICAL.

Every part of the work shown in the succeeding illustrations was designed, constructed and erected under the direct personal supervision of our engineers. We can do equally good work for you, and you can be sure of best results, whether your contract is large or small.

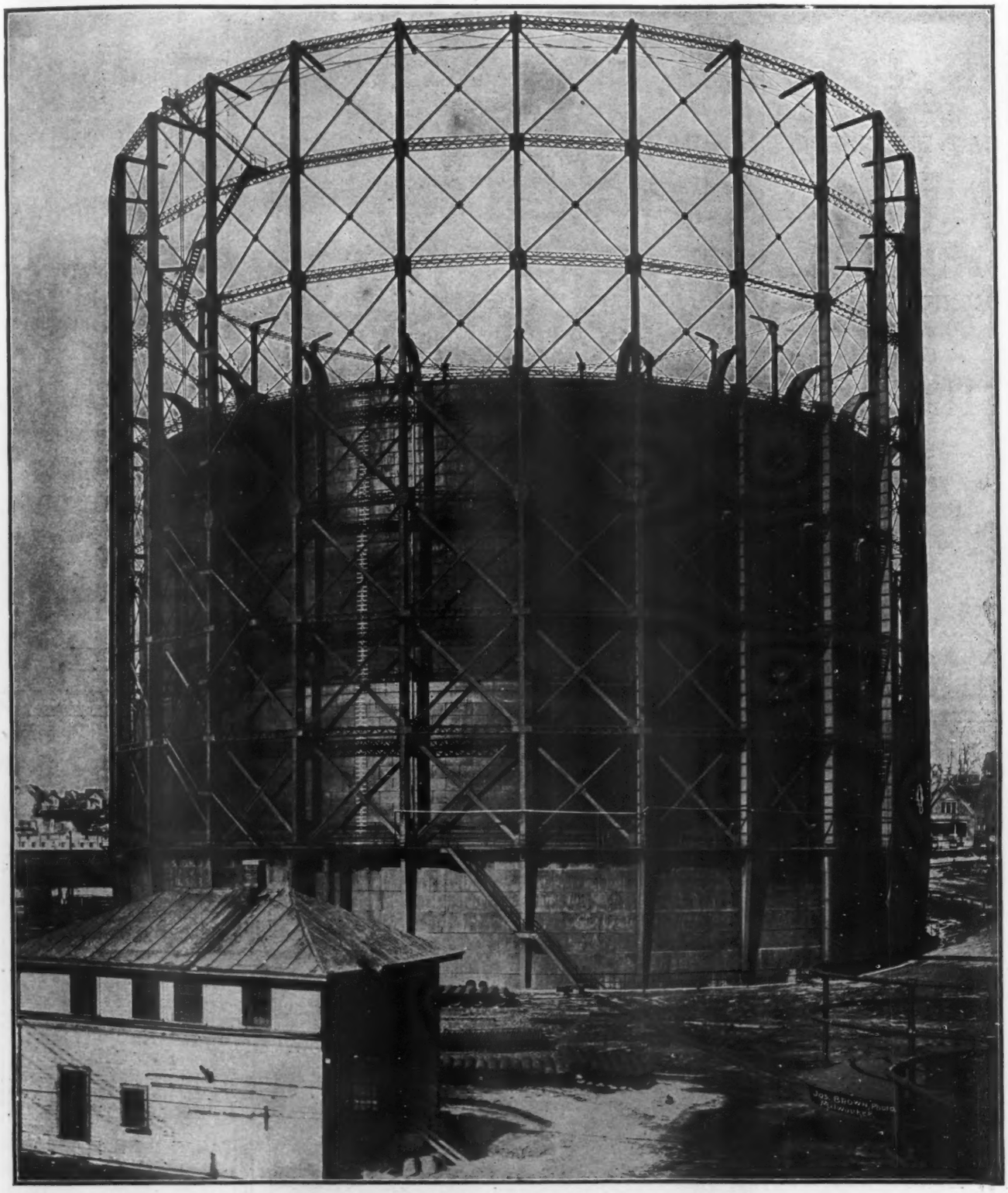
Erection of 4 stacks, each with 7 benches 20-foot throughs.



A stack of Inclines ready for the benches.

GAS WORKS DIVISION: A. S. B. LITTLE, Engineer.

SAINT LOUIS · MISSOURI



The Largest Steel Tank Gasholder in the World, 225 Feet 9 Inches Diameter, 35 Feet Deep, Five Lifts.

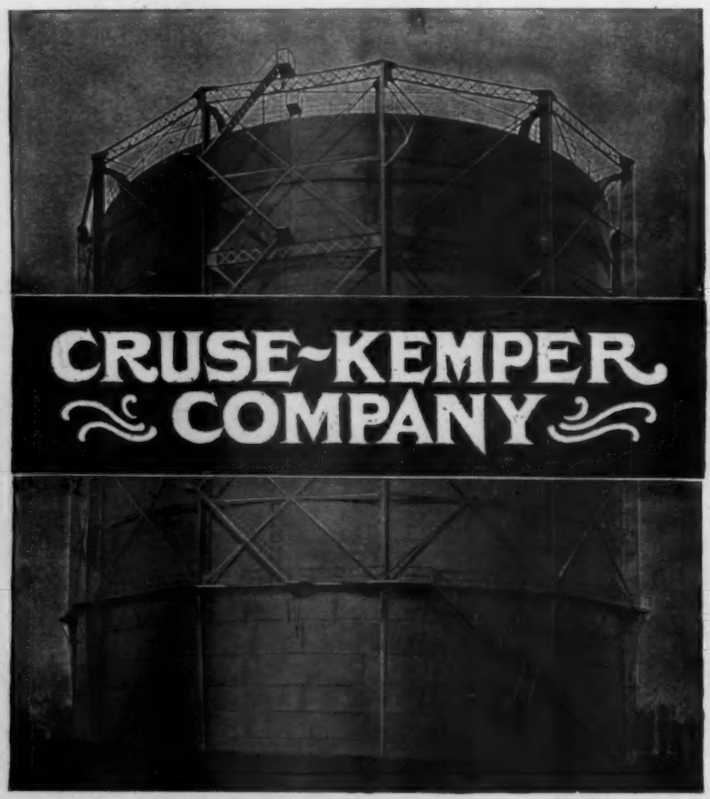
RITER-CONLEY MFG. CO.,

PITTSBURGH.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

COMPLETE COAL GAS PLANTS.

GAS ENGINEERS,
BUILDERS OF
GAS HOLDERS,
PURIFIER BOXES,
CONDENSERS,
SCRUBBERS,
STEEL TANKS,
PLATE METAL CONSTRUCTION.



STEEL WATER AND TRANSMISSION TOWERS.
STEEL BUILDINGS and ROOF TRUSSES.
STRUCTURAL IRON & STEEL WORK IN GENERAL.

OFFICE AND WORKS, - - - - AMBLER, PA.

J. S. DeHART, JR., PRESIDENT
A. F. WEHNER, SECRETARY
R. K. WEHNER, TREASURER

ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

BENCH WORK
CHARGING AND DISCHARGING MACHINERY
MACKENZIE EXHAUSTERS
PRIMARY AND SECONDARY CONDENSERS FOR FRESH OR SALT WATER

ISBELL VALVES SPECIALS
TAR EXTRACTORS
P. & A. TAR EXTRACTORS FOR WATER GAS
ROTARY AMMONIA SCRUBBERS
SHAVING SCRUBBERS PURIFIERS STREET GOVERNORS

MAIN OFFICE AND WORKS
BRIDGE & OGDEN STREETS
NEWARK, N. J.
ESTABLISHED 1865

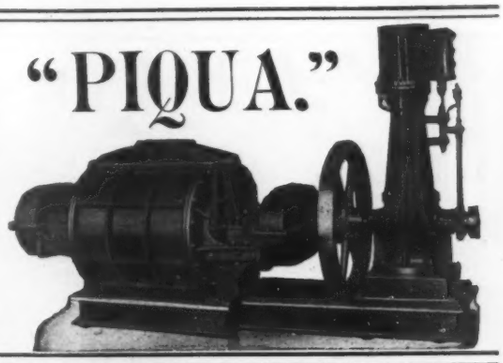
GAS EXHAUSTERS AND BLOWERS.

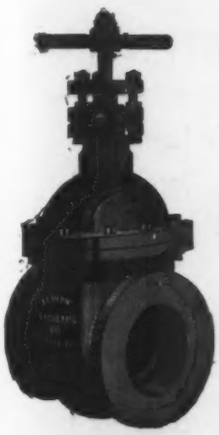
We have a full line of sizes for all standard pressures. The design, material and workmanship is A-1. Prompt Delivery and Reasonable Prices. WHY NOT give us YOUR requirements?

THE PIQUA BLOWER CO.,

PIQUA, OHIO.

"PIQUA."





THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

QUINTARD IRON WORKS CO.,

Foot of Twelfth Street and East River, New York,

BENCH WORK,
CONDENSERS,
SHAVING SCRUBBERS,
CAST IRON FLANGED PIPE,
RIVETED STEEL PIPE.

FREDERICK W FLOYD, Engineer.

ESTABLISHED 1866.

HENRY MAURER & SON,

Manufacturers of

High Grade Firebrick, Blocks, Tiles,

ETC.,

Works: Maurer, N. J. Office: 420 E. 23d St., N. Y. City.

L. C. HAMLINK, PRES. AUGUST COURT, SEC'Y.

GAS BENCH CONSTRUCTION COMPANY,

METROPOLITAN BUILDING, ST. LOUIS, MO.,

Engineers and Builders of all styles of Standard and Special Benches from one to twelve Retorts, Horizontal, Vertical, or Inclined.

We will guarantee "Better Benches," to be easier to control, make more gas per retort, and operate with less fuel than any bench on the market.

ALL WORKMANSHIP AND MATERIAL GUARANTEED.

PRACTICAL HANDBOOK ON GAS ENGINES. WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME.

By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEORGE M. RICHMOND, M.E. Price, $1.

For Sale by A. M. CALLENDER & CO., 42 Pine St., New York City.

"Ironclad" Dry Gas Meters

are equally suitable for the measurement of either artificial or natural gas.

Catalogue No. 100 Free.

Pittsburg Meter Co.

General Office and Works, East Pittsburg, Pa.

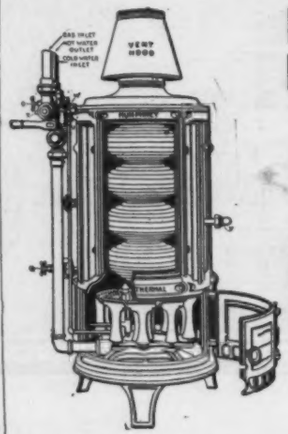
New York, 149 Broadway. Chicago, 256 Madison St. Kansas City, 6 West 10th St. Minneapolis, 409-411 2d Av. South.

Manufacturers of Gas Meters and Water Meters.

LLOYD CONSTRUCTION COMPANY

GAS APPARATUS.

DETROIT - MICHIGAN



Humphrey Auto-Thermal Instantaneous Water Heaters

Have every known desirable feature helping to efficiency, economy, durability and absolute safety.

FULLY GUARANTEED.
PRICES LOW.
QUALITY AND SERVICE HIGH.

Will you help us sell them?

HUMPHREY CO.,
Kalamazoo Mich., U. S. A.

"THE MINER"
GLOBE STREET LAMPS.

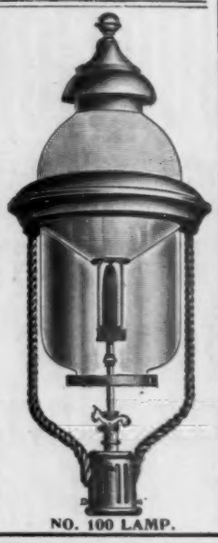
OVER FORTY YEARS IN USE THE WORLD OVER.

THE BEST STREET LAMPS for ALL KINDS OF GAS OR BURNERS.

This is only one of a Large Variety of Styles.

SEND FOR CATALOGUE.

THOS. T. W. MINER,
821 and 823 Eagle Avenue, New York.



NO. 100 LAMP.

Binder FOR THE Journal. PRICE, $1.

For Sale by A. M. CALLENDER & CO., 42 Pine Street, New York City.

PRACTICAL PHOTOMETRY,

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

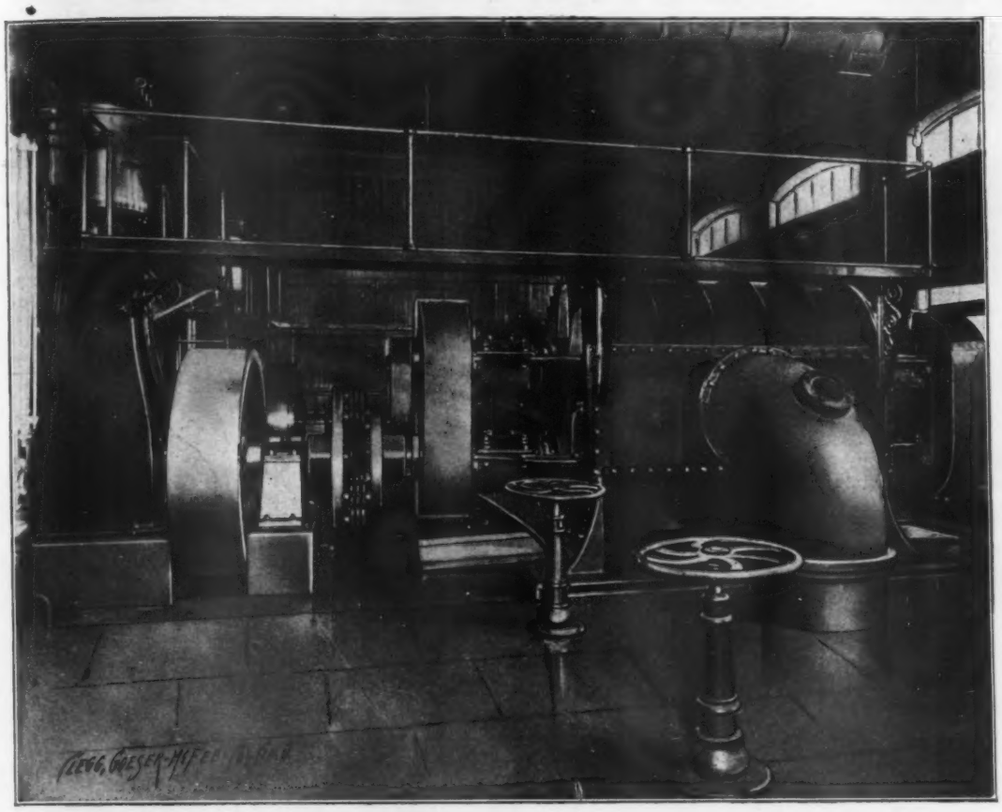
By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00.

FOR SALE BY

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

50TH ANNIVERSARY.



ROOTS' GAS EXHAUSTERS.

Installation showing our latest improved machines, wilh flexible rope couplings, for large units.

SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

SEND FOR POCKET EDITION OF "ENGINEERS' PRACTICAL REFERENCE BOOK."

The "Gas World" Analyses of Accounts of Gas Undertakings,

For 1906-1907,

Showing at a glance the Accounts of 113 Coal and Water Gas Companies, Itemized under

Coal Carbonized, Gas Made and Sold, Yield of Residuals, Public Lamps, Mileage of Mains, Consumers, Price of Gas, Illuminating Power, Financial Results, Revenue.

Manufacturing Charges, Rates and Taxes, Distribution Charges, Management Charges, Bad Debts, Capital Paid Up, Capital per Ton and per Thousand, Reserve Funds, etc.

EVERY GAS ENGINEER AND MANAGER SHOULD HAVE A COPY OF THIS INVALUABLE AND UP-TO-DATE WORK.

Price, $4. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - **$6.50.**

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

BRAY UNION JETS

Recommended by the Public Service Commission.

The following appeared in THE NEW YORK TIMES January 24, 1909:

"The Public Service Commission for the Second District, in its second annual report, call attention to the following:

"**Metal Tips should never be placed on burners, as they waste gas.** The conclusion is reached from a study of all the various factors which enter into the ideal burner and after an examination of the comparative merits that the BRAY UNION JET IS SUPERIOR FOR GENERAL USES."

"THE CONSOLIDATED GAS CO., OF NEW YORK, Gave 329,397 Bray Burners to their consumers in 1908."

W. M. CRANE COMPANY,

SOLE AGENTS.

New Address: 16, 18 & 20 West 32d Street, New York.

GEORGE ORMROD, Pres. & Treas. JOHN D. ORMROD, Supt.
J. G. EBERLEIN, Secretary.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS & WATER PIPE

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

BRISTOL'S

REG. U. S. PAT. OFFICE.

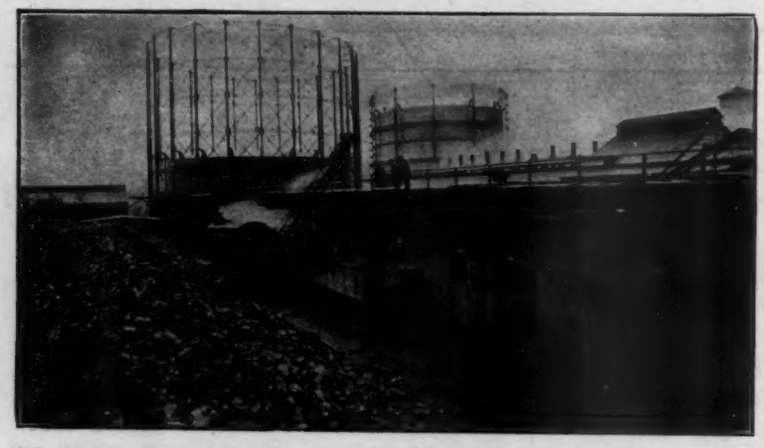
RECORDING GAUGES

FOR ALL RANGES OF PRESSURE AND VACUUM.

Write for New Bulletins.

THE BRISTOL CO., WATERBURY, CONN.

New York, BRANCH OFFICES. Chicago.



WRITE for our Catalogue "O" just issued. This Catalogue deals entirely with "Brownhoist" Machinery as used at Artificial Gas Plants for handling coal, coke and other materials rapidly and economically.

THE BROWN HOISTING MACHINERY COMPANY,

Designers and Builders of All Kinds of Hoisting Machinery.

Main Office and Works:
CLEVELAND, O.

Branch Offices:
NEW YORK AND PITTSBURG.

STANDARD REDUCTION FACTORS FOR GASES,

A Number of Tables Necessary for the Reduction of the Volume of any Gas at any Temperature, Pressure and Degree of Saturation to its Equivalent Volume under Standard Conditions,

TOGETHER WITH

A Table for the Numerical Solution of Certain Exponential Equations,

By HELON BROOKS MacFARLAND, B.S., M.M.E.,

Associate Professor of Applied Mechanics, Department of Mechanical Engineering, Armour Institute of Technology, Chicago, Ills.

PRICE, $1.50. For Sale by

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

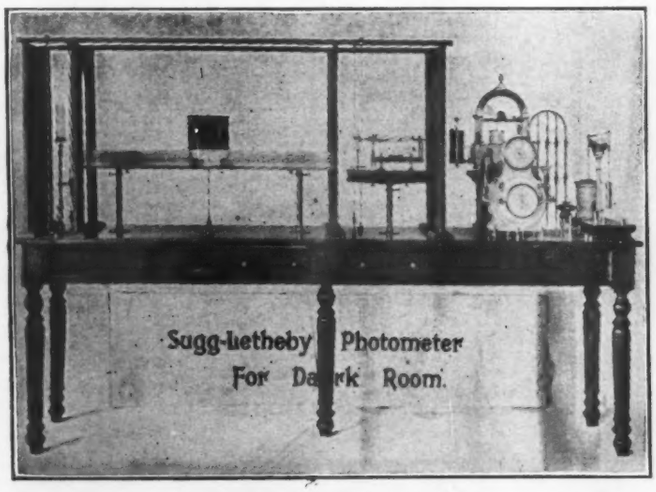
JUNE, 1909.

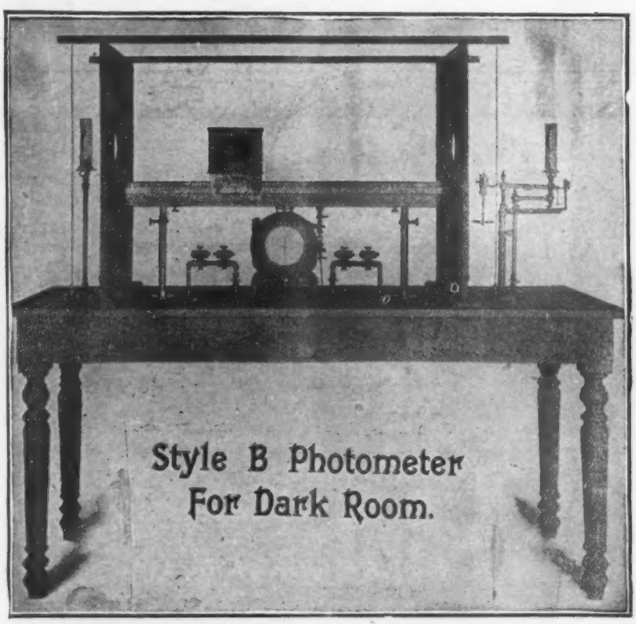
Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Tue.	1	2.40AM	3.30AM
Wed.	2	No L.	No L.
Thu.	3	No L.FM	No L.
Fri.	4	No L.	No L.
Sat.	5	7.50PM	10.20PM
Sun.	6	8.00	11.10
Mon.	7	8.00	12.00
Tue.	8	8.00	12.40AM
Wed.	9	8.00	1.20
Thu.	10	8.00LQ	1.50
Fri.	11	8.00	2.20
Sat.	12	8.00	2.40
Sun.	13	8.00	3.10
Mon.	14	8.00	3.30
Tue.	15	8.00	3.30
Wed.	16	8.00	3.30
Thu.	17	8.00NM	3.30
Fri.	18	8.00	3.30
Sat.	19	8.00	3.30
Sun.	20	8.00	3.30
Mon.	21	8.00	3.30
Tue.	22	10.10	3.30
Wed.	23	10.40	3.30
Thu.	24	11.10	3.30
Fri.	25	11.30FQ	3.30
Sat.	26	11.50	3.30
Sun.	27	12.10AM	3.30
Mon.	28	12.40	3.30
Tue.	29	1.10	3.30
Wed.	30	1.50	3.30

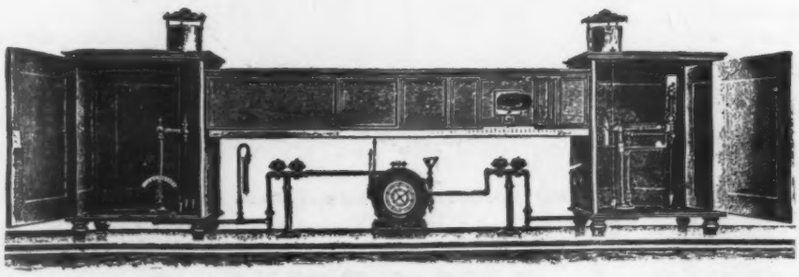
TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JUNE, 1909.

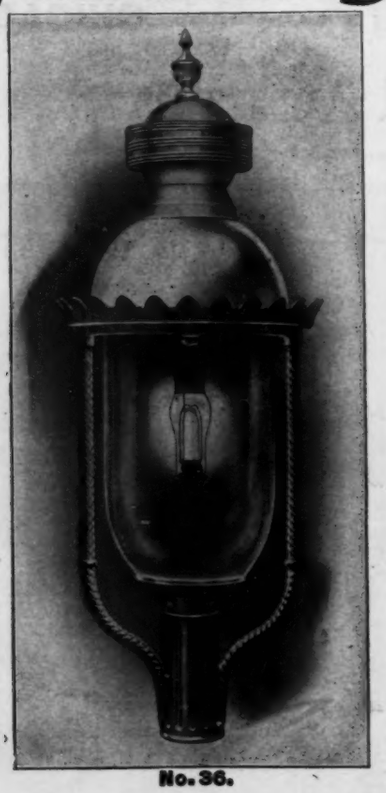
Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Complete Lighting in One Hour From Time Given P. M.	Complete Extinguishing in 50 Minutes From Time Given A. M.
Tue.	1	7.12	3.17
Wed.	2	7.12	3.17
Thu.	3	7.12	3.17
Fri.	4	7.17	3.12
Sat.	5	7.17	3.12
Sun.	6	7.17	3.12
Mon.	7	7.17	3.12
Tue.	8	7.17	3.12
Wed.	9	7.17	3.12
Thu.	10	7.17	3.12
Fri.	11	7.17	3.07
Sat.	12	7.17	3.07
Sun.	13	7.17	3.07
Mon.	14	7.17	3.07
Tue.	15	7.17	3.07
Wed.	16	7.17	3.07
Thu.	17	7.17	3.07
Fri.	18	7.22	3.07
Sat.	19	7.22	3.07
Sun.	20	7.22	3.07
Mon.	21	7.22	3.07
Tue.	22	7.22	3.07
Wed.	23	7.22	3.07
Thu.	24	7.22	3.07
Fri.	25	7.27	3.07
Sat.	26	7.27	3.07
Sun.	27	7.27	3.07
Mon.	28	7.27	3.07
Tue.	29	7.27	3.07
Wed.	30	7.27	3.07

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



No. 36.

....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

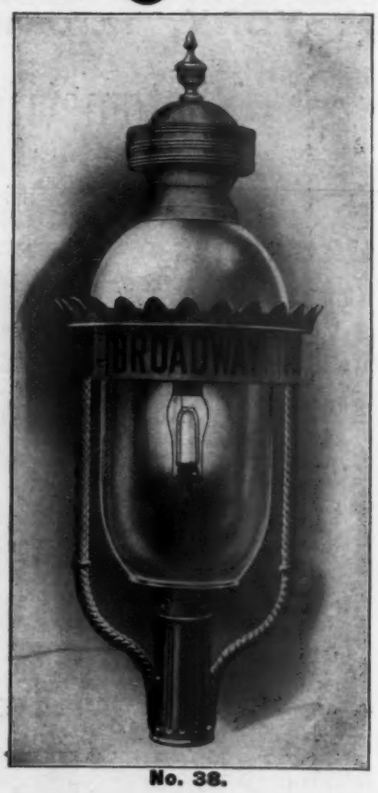
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

Welsbach Junior

THE BIGGEST LITTLE LIGHT IN THE WORLD.

The Welsbach Junior Light is 5 inches high--consists of burner, mantle and chimney--and is attractively boxed in a pasteboard carton.

As its effectiveness and economy become better known the Welsbach Junior will supersede, for universal use in the home, the old-style open flame gas burners.

Showing Welsbach Junior Light used in connection with ordinary glass globe.

Gives 50-Candle Power.

Uses Two Feet of Gas per Hour.

Attaches to Any Gas Fixture.

Completely Hidden from View.

Use your own globe--either gas or electric.

SMALL—EFFICIENT—ECONOMICAL.

Welsbach Company, FACTORIES: Gloucester, N. J. Columbus, O.

Salesrooms in all Leading Cities of the United States.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

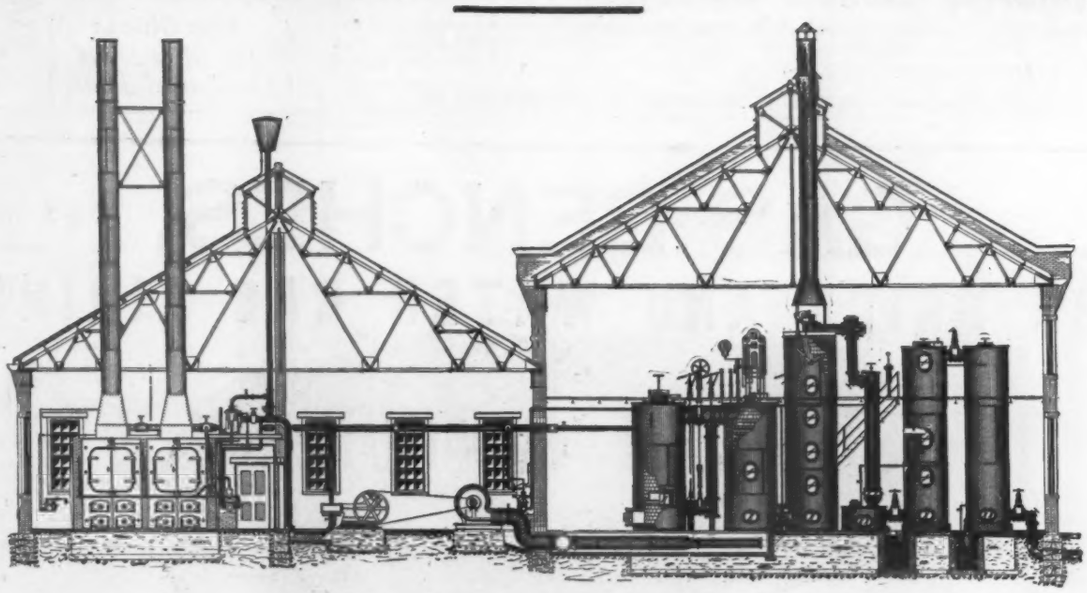
LESSEES, OPERATORS AND BUILDERS OF **GAS WORKS.**

Largest Builders of CARBURETTED WATER GAS PLANT IN AMERICA.

SOLE AMERICAN BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.



TOTAL SETS INSTALLED TO DECEMBER 31, 1908, ... 690
TOTAL DAILY CAPACITY, TO DECEMBER 31, 1908, ... 558,565,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.
Waste Heat Boiler.
Hygrometer.
Meters for Regulating Air and Steam Supply to Water Gas Apparatus.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

KRATER-DINAS RETORT CEMENT.

Universally accepted to be the best cement for patching and repairing retorts, making up bench work, etc. Advantages: Powdered form; only mix with water; no waste; too much mixed, apply water and use the next time; adheres very easy; does *not* fall out by decarbonization. We guarantee or take back. Many re orders and recommendations from America, Germany, France, Belgium, etc. Write for price and testimonials.

STRASSBURGER BROS., Sole Importers,
563 Lincoln Avenue, Chicago, Ills.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b NEW CASTLE, PA.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,
29 North Mill St., New Castle, Pa.

"BEST BY TEST."
ESTABLISHED 1868.

L. N. RANCKE, V. Pres. & Mgr. E. L. RIEHA, Engineer.

BALTIMORE RETORT & FIREBRICK CO.
BALTIMORE, MD.

HIGH GRADE FIRECLAY MATERIAL FOR ALL PURPOSES.

DESIGNERS AND BUILDERS OF

BENCH CONSTRUCTIONS of the MOST DURABLE and EFFICIENT TYPE, WITH EITHER HORIZONTAL, INCLINED OR VERTICAL RETORTS.

SUPERIOR GRADE LININGS AND CHECKERBRICK FOR WATER GAS SETS.

WE SOLICIT YOUR INQUIRIES.

WALDO BROS., 102 Milk St., BOSTON, MASS.,
AGENTS FOR NEW ENGLAND STATES.

LARGE MODERN FACILITIES.
RAIL AND WATER CONNECTIONS TO ALL POINTS.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

GAS BENCHES,

FIRE BRICK AND WATER GAS LININGS.

LATEST DESIGNS,
HIGHEST GRADE MATERIAL,
SUPERIOR WORKMANSHIP,
UNEQUALED RESULTS.

DESIGNS AND SPECIFICATIONS FURNISHED ON THE HORIZONTAL, INCLINED OR VERTICAL RETORT SYSTEMS FOR COMPLETE GAS WORKS.

LACLEDE-CHRISTY CLAY PRODUCTS CO.,
ST. LOUIS, MO.

EXPERT INSPECTION of Holders and Other Structures During Construction.
ECONOMIC DESIGN of Steel Structures, Reinforced Concrete, Masonry and Foundations.
CHAMBERS & HONE, Consulting Engineers, ... 15 William Street, New York City.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada, Detroit, Seattle, Rochester and St. Louis.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich., and Cincinnati, Ohio. These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

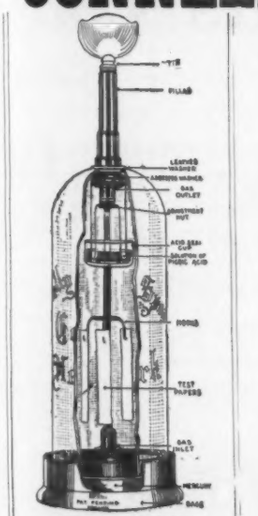
Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins. Coke Screening and Measuring Plants a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



SULPHUR TESTER.

Automatic, Balance, High Pressure and Service Governors,

Unison Telemetric Pressure Gauge,

Iron Sponge, Purifying Material for Gas Purification, Manufacturers of Jones Jet Photometers, The National Smoke and Ammonia Helmet, Sulphur Testers, High and Low Pressure House Governors.

Wide Experience in High Pressure Installation and Extension.

PACIFIC COAST AGENT: VAN E. BRITTON, SAN FRANCISCO, CAL.

50 CHURCH ST., NEW YORK CITY.
295 WEST 22D ST., CHICAGO, ILLS.

12-Inch High Pressure Governor.

REYNOLDS' GAS REGULATOR COMPANY,

ANDERSON, IND., U. S. A.

We make all sizes for all classes of reduction,

Double and Single District Stations,

And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

And Low Pressure Regulators, all of the Dry Diaphragm type.

English Agents:
THE BRYAN DONKIN CO., LTD., Chesterfield, England.

Write for Catalog.

Combination Governor.
(Governor and Mercury Seal.)

Newbigging's Handbook for Gas Engineers and Managers.

Price, $6.50. For Sale by
A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

COAL TAR AND AMMONIA,

By GEORGE LUNGE, PH.D. Third and Enlarged Edition.
Price, $15. For Sale by
A. M. CALLENDER & CO., 42 Pine Street, New York City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

OCEAN MINE YOUGHIOGHENY GAS COAL,
OLD KENTUCKY SHALE AND O. K. BOGHEAD.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Secretary and Treasurer.

Works, LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

Address all communications to JAMES GARDNER, JR., CO., Bolivar, Pa.

Fire Clay Goods for Gas Works.

Double Gate Valves.

A LARGE STOCK ON HAND READY FOR PROMPT SHIPMENT.

These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.....	8 inches	10 inches	12 inches	16 inches	20 inches	24 inches	30 inches	36 inches
Diameter of flanges....	13 inches	16 inches	18 inches	22½ inches	27 inches	31 inches	31½ inches	44 inches
Face to face of flange...	12 inches	12 inches	12 inches	14 inches	17 inches	20 inches	21 inches	23⅞ inches

For price and other information, apply to

THE CONTINENTAL IRON WORKS,
P. O. STATION G. NEW YORK (BOROUGH OF BROOK

Directory of American Gas Companies, 1908.

Price, $5.00.
For Sale by
A. M. Callender & Co. 42 Pine St., N. Y.

KELLER ADJUSTABLE COKE CRUSHER.

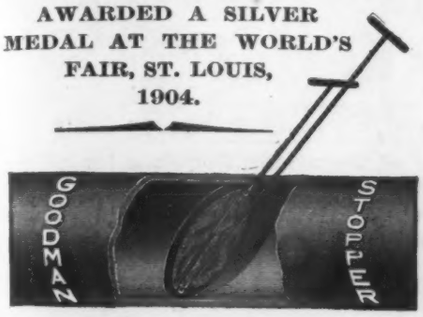
Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,

Columbus, Ind.

Correspondence Solicited.

AWARDED A SILVER MEDAL AT THE WORLD'S FAIR, ST. LOUIS, 1904.



AGENTS.

Pacific Coast—VAN E. BRITTON, 269 Monadnock Building, San Francisco, Cal.

Great Britain—PARKER & LESTER, Old Kent Road, London.

MANUFACTURED BY

SAFETY GAS MAIN STOPPER CO.,

257-263 East 133d Street,

NEW YORK CITY.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.

EDMUND H. McCULLOUGH, President. H. C. ADAMS, Vice-President. CHAS. F. GODSHALL, Treasurer. HENRY WHARTON, Secretary. C. B. NICHOLS, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

GAS MAINS—SERVICE PIPES.

Their installation for High or Low Pressure is the work in which we have specialized for years. Because of our Facilities and Experience, many Gas Companies prefer to contract with us for such work, rather than to execute it themselves. It proves to be as cheap in the end. We solicit inquiries. SULLIVAN BROS.,

Telephone Connection. 11 Main St., Flushing, N. Y.

JOHN CABOT, President. GEO. D. CABOT, Secretary.

1412-1428 Adams Street, Hoboken, N. J.

PURIFIER AND SCRUBBER TRAYS.

Church's Patent Trays,

Reversible; Strongest; Most Easily Repaired.

We also Supply the Cheapest and Strongest

Reversible Bolted Trays.

Special Trays for Iron Oxide in Either Style.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,

DAYTON, O.

AMERICAN GAS ENGINEERING PRACTICE,

A HANDBOOK FOR ALL ENGAGED IN THE INDUSTRY,

Comprising Many Details Not Heretofore Published,

By M. NISBET LATTA, C.E.,

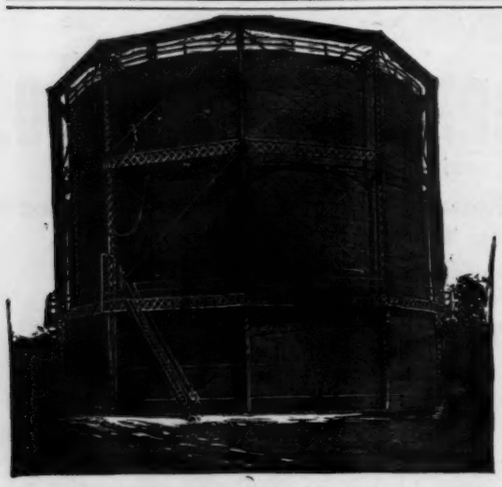
PART I. WATER GAS MANUFACTURE. The Generator. The Carburetter. The Superheater. Wash Box and Tar. Scrubbers. Condensers. Purifiers. Exhausters. Station Meters. Holders. Details of Works' Operation.

" II. GAS DISTRIBUTION. Naphthaline. Mains. Services. Consumers' Meters. Pressure. House Piping. Appliances.

" III. GENERAL TECHNICAL DATA. Properties of Gases. Steam. Mathematical Tables. Conversion Factors. Pipe and Miscellaneous Data.

Price, $4.50. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.



DAVIS & FARNUM MFG. CO.,
Principal Office and Works, Waltham, Mass.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

H. M. BYLLESBY & COMPANY
(INCORPORATED).

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE
COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

EXAMINATIONS AND REPORTS.

AMERICAN TRUST BUILDING
CHICAGO.

Oklahoma City, Okla. Mobile, Ala. San Diego, Cal.

ALEX. C. HUMPHREYS, President.
WM. W. RANDOLPH, Vice-President.
EMILE GUILLAUDEU, Treasurer.
ROBT. O. LUQUEER, Secretary.
HOWARD E. WHITE, General Counsel.

EUROPEAN CORRESPONDENTS.
HUMPHREYS & GLASGOW
LONDON. — BRUSSELS.

HUMPHREYS & GLASGOW, INC.,
CONSULTING ENGINEERS

ADVICE AS TO EXTENSION, MANAGEMENT AND RECONSTRUCTION OF GAS AND ELECTRIC PLANTS.

COMPLETE EXAMINATIONS MADE. ~ ~ ~ PROPERTIES PURCHASED.

CITY INVESTING BUILDING, 165 BROADWAY, NEW YORK.

HENRY I. LEA,
GAS ENGINEER.

DESIGN, CONSTRUCTION AND MANAGEMENT OF GAS PLANTS.

EXAMINATIONS AND REPORTS.

THE ROOKERY, CHICAGO.

McDONALD-MANN QUENCHING CHUTES.

McDonald-Mann chutes with cable car in position to receive the quenched coke, Cleveland Gas Light and Coke Co.

Some of the economical advantages of these chutes are:

The coke is quenched in closed bins.
Smaller amount of breeze than by any other method.
Minimum loss from incipient combustion.
Entire absence of steam and gases.
Ease of drawing the coke from the chute into the c. r.

Gas engineers, both designing and operating, should investigate this method of handling coke, and the names of the nearest Gas works using this system will be furnished to those interested in seeing it in operation.

COAL AND COKE HANDLING MACHINERY IS OUR SPECIALTY.

Send for Catalogue B-1.

C. W. HUNT COMPANY,
WEST NEW BRIGHTON, N. Y. NEW YORK OFFICE, 45 BROADWAY.

Celebrated Lux Gas Purifying Mass

Will Save 50 Per Cent. Labor.

Sole Importer, F. BEHREND,
54 Front St., New York.

The Bartlett-Hayward Company,

Baltimore, Md. 100 Broadway, New York.

GASHOLDERS,

Coal and Water Gas Plants.

Western Representative: W. A. BAEHR, Commercial National Bank Building, Chicago, Ills.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS
AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single or Multiple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

THE FULTON GAS PRESSURE GOVERNORS

For Artificial or Natural Gas.
For District or Individual Service.

Our Improved **Duplex Sensitive Governor** for district service will reduce high pressure gas to inches of water without variation. Absolutely safe and reliable. No complicated mechanism to get out of order. No auxiliary regulators or other devices to assist the main governor required. The most simple and perfect governor ever placed on the market. We also manufacture Holder Governors, Compressor Governors and Individual Service Governors for any inlet and outlet pressure.

More than 20 years' experience with the largest gas companies. Send for Catalog.

THE CHAPLIN-FULTON MFG. CO.,

VAN E. BRITT N. Pacific Coast Agent, Monadnock Bldg., San Francisco, Cal. 28-34 PENN AVE., PITTSBURGH, PA.

COAL TAR AND AMMONIA.

THIRD AND ENLARGED EDITION.

BY

GEORGE LUNGE, PH.D.

Price, $15. For Sale by

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

THE GAS ENGINEER'S POCKET-BOOK,

By HENRY O'CONNOR,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

FOR SALE BY

A. M. CALLENDER & CO., - No. 42 Pine Street, New York City.

Established 1851. Incorporated 1880.

THE STACEY MFG. CO.,

Gas Engineers and Builders.

Gas Holders

Roofs, Condensers, Washers, Purifiers, Valves, Cast Connections, Street Specials, Oil and Water Tanks, Stand Pipes, Etc.

General Offices and Works:
Elmwood Place Station, CINCINNATI.

WESTERN OFFICE: 718 Mission Street, San Francisco, Cal.

CORRESPONDENCE SOLICITED.

THESE BOOKS ARE NEW.

LIQUID AND GASEOUS FUELS,
By Vivian B. Lewes.
334 pages. . . . . Price, $2.

THE GAS ENGINE,
By Forrest R. Jones. 447 pages and 142 cuts. Price, $4.

HEATING,
By W. J. Baldwin.
Price, ... $2.50.

HEAT, ENERGY AND FUELS,
By Oskar Nagel. 306 pages and 118 illustrations. Price, $3.

PRODUCER GAS AND GAS PRODUCERS,
By Samuel S. Wyer. 295 pages. Price, $4.

LAW AND BUSINESS OF ENGINEERING AND CONTRACTING,
By Charles E. Fowler. Price, $2.50.

GAS PIPING AND GAS LIGHTING,
By W. P. Gerhard.
310 pages. . . . . Price, $3.

GAS POWER,
By F. E. Junge, M.A., C.E., M.E.
548 pages. . . . . Price, $5.

GAS, GASOLINE AND OIL ENGINES,
Including Producer Gas Plants.
By Gardner D. Hiscox, M.E. Price, $2.50.

STANDARD WORKS.

GAS MANUFACTURE,
By W. J. A. Butterfield.
Price, ... $2.50.

HANDBOOK ON GAS ENGINES,
By G. E. Lieckfeld, C.E. Translated by George M. Richmond, M.E. Price, $1.

GAS AND GAS WORKS,
By Hughes and O'Connor.
Price, ... $2.50.

CHEMISTRY OF GAS MANUFACTURE,
By Harold M. Royle, F.C.S.
Price, ... $4.50.

GAS MANUFACTURE FOR STUDENTS,
By John Hornby.
Price, ... $1.50.

COAL TAR AND AMMONIA,
By George Lunge.
Price, ... $15.

GAS ANALYST'S MANUAL,
By Jacques Abady.
Price, ... $6.50.

SELF-INSTRUCTION FOR STUDENTS,
Elementary, Advanced, Constructional.
Price, ... Each, $1.50.

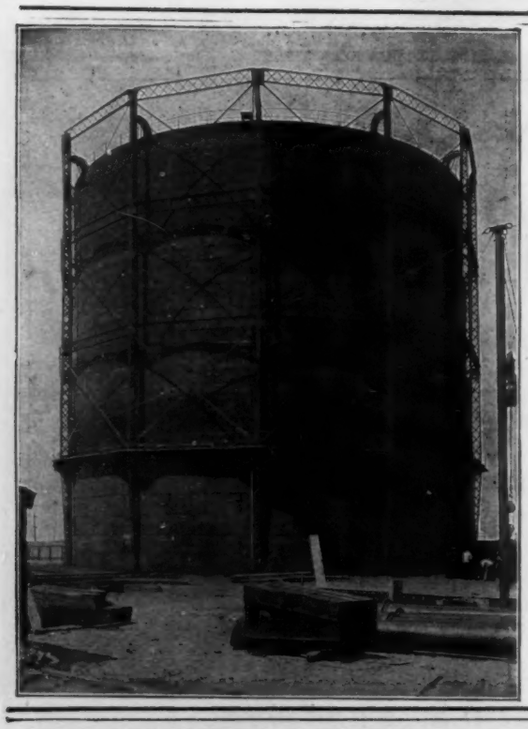
PRACTICAL PHOTOMETRY,
By W. J. Dibdin.
Price, ... $3.

MODERN RETORT SETTINGS,
By G. P. Lewis.
Price, ... $1.50.

ART OF ILLUMINATION,
By Dr. Louis Bell.
Price, ... $2.50.

GAS COMPANIES' BOOKKEEPING,
By Brearley and Taylor.
Price, ... $4.50.

We will be Glad to Furnish Any Engineering Book.
SEND CHECK, DRAFT, POST OFFICE or EXPRESS MONEY ORDER.
AMERICAN GAS LIGHT JOURNAL, - . 42 PINE STREET, NEW YORK CITY.



JOHN FOWLER, President. J. SCOTT FOWLER, Vice-Pres. & Treas.

DEILY & FOWLER MFG. CO.,

39 Laurel Street, Philadelphia, Pa.

ESTABLISHED 1842. INCORPORATED, 1908.

BUILDERS OF

GASHOLDERS,

Single-Lift or Telescopic,

With or Without Steel Tanks.

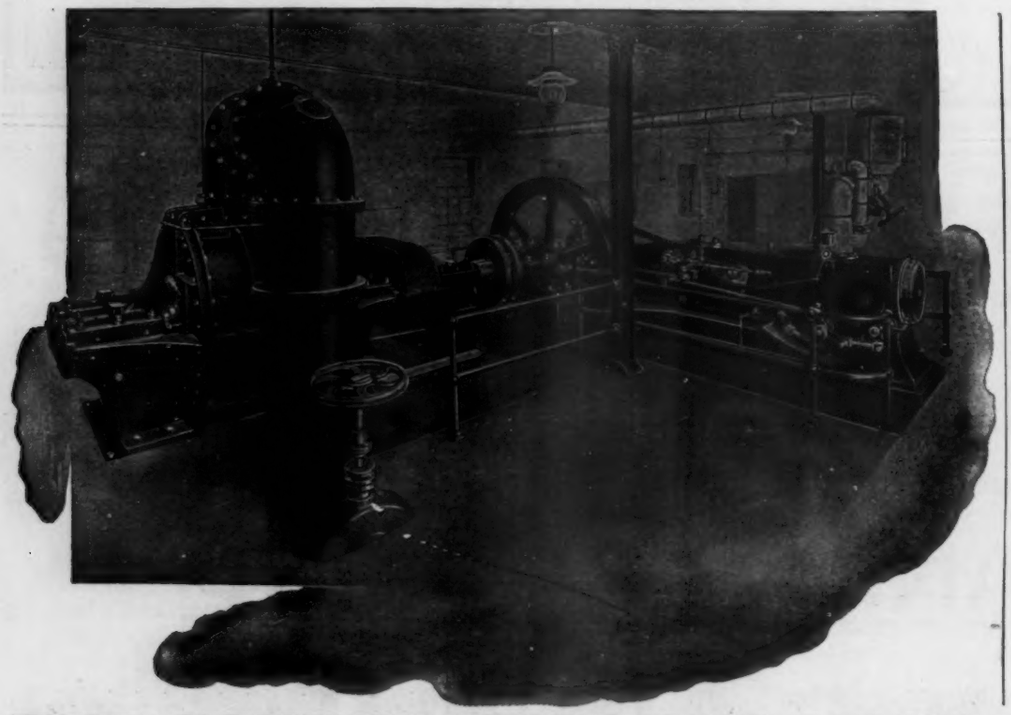
Oil Storage Tanks, Water Tanks, Etc.

ESTIMATES CHEERFULLY FURNISHED.

CORRESPONDENCE SOLICITED.

CONNERSVILLE GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS.



THIS cut shows one of our High Pressure machines and a 4-valve engine connected by one of our leather link flexible couplings. Two of these units were installed for the Peoples Gas Light and Coke Co., Chicago, at their 73d St. Station. Each machine has a capacity of 14,000,000 cubic feet per day.

—o—

We also manufacture

GAS VALVES,
BY-PASS VALVES,
PRESSURE REGULATORS,
ETC., ETC.

Correspondence Solicited.

THE CONNERSVILLE BLOWER COMPANY,
Connersville, Indiana, U. S. A.
NEW YORK OFFICE, 50 Church Street. - - HORACE C. COOKE, Selling Agent.

1908 DIRECTORY 1908

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

AMERICAN GAS LIGHT JOURNAL, - 42 Pine St., New York City.

D. McDONALD & CO.,

971-997 BROADWAY, ALBANY, N. Y.,

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, PREPAYMENT METERS, METER PROVERS AND GAUGES.

THE GLOVER PREPAYMENT METER,

Simple, Strong, Satisfactory.

THE HINMAN STATION METER DRUM,

The greatest advance that has been made in 20 years in the ACCURATE and ECONOMICAL measurement of gas in large quantities. :: :: ::

NEW YORK OFFICE: 561 West 47th Street. | ALBANY OFFICE: 991 Broadway. | CHICAGO OFFICE: Jefferson and Monroe Streets.

The Sprague Meter Co.

Manufacturers of

Cast Iron Gas Meters

for

Artificial or Natural Gas

Plain or Prepayment

Lower in first cost and cheaper to maintain than any meter on the market.

Write us for particulars.

The Sprague Meter Company

203 Water St., Bridgeport, Conn.

ALCOHOL, Its Manufacture from Farm Products and De-Naturing,

By F. B. WRIGHT.

A NEW AMERICAN BOOK.

CONTENTS.

Chapter 1. Alcohol, its various forms and sources.
" 2. Mashing, cooling and fermentation in general.
" 3. Distillation, simple forms of stills, the production of Alcohol from wine.
" 4. Malting.
" 5. Alcohol from Potatoes, mashing, fermentation, distillations, Continuous stills.
Chapter 6. Alcohol from Grain.
" 7. Alcohol from Beets.
" 8. Alcohol from Sorghum and Molasses.
" 9. De-natured Alcohol and its Commercial uses.
" 10. Alcoholometry. Index.

Fully Illustrated with Original Drawings of Necessary Apparatus.

PRICE, $1. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

NATHANIEL TUFTS METER COMPANY,

455 Commercial St., Boston, Mass.

PREPAYMENT GAS METERS,
WET AND DRY GAS METERS, STATION METERS, ETC.

REPAIRING OF ALL MAKES OF METERS, AND FITTED WITH OUR PREPAYMENT ATTACHMENT.

B

METERS.

INCREASED CAPACITY.
INCREASED EFFICIENCY.

PREPAYMENT METERS, STATION METERS, METER PROVERS, ETC.

PROMPT AND CAREFUL ATTENTION TO ALL **REPAIR WORK.**

MARYLAND METER COMPANY,

BALTIMORE.—CHICAGO.

YOU NEED ONE OR MORE OF OUR COMPLAINT METERS.

METERS, Plain and Prepayment,

For Artificial or Natural Gas.

Repairing All Makes and Attachments Added if Desired.

SPECIAL METERS FOR ACETYLENE.

KEYSTONE METER COMPANY,

ROYERSFORD, PA.

JUDICIOUS ECONOMY IS EFFECTED

BY USING

5-L. IMPROVED GAS METERS.

LOW SPEED, LARGE DIAPHRAGMS, STRONGER CONSTRUCTION, LARGER CAPACITY.

FITTED WITH

THE NEW YORK PREPAYMENT ATTACHMENT.
STEEL BOX AND CABINET LOCK.

NEW YORK IMPROVED METER CO., 306-310 East 47th St., New York City.

PACIFIC COAST REPRESENTATIVE: THE NORTHWEST GAS EQUIPMENT CO., Portland, Ore.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers,
Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

INLET AT TOP.

PATENTED MAY 13, 1902.

STANDARD AND SELF-DRAINING GAS METERS.

PLAIN OR PREPAYMENT FOR ARTIFICIAL OR NATURAL GAS.

LARGE CAPACITY.
LOW SPEED.
STRONG CONSTRUCTION.

REPAIRING OF ALL MAKES OF METERS.

UNITED STATES METER COMPANY,

229 to 269 Chestnut Street, Brooklyn, N. Y.

INLET AT BOTTOM.

PATENTED MAY 13, 1902.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,
PHILADELPHIA.

559 West 47th Street,
NEW YORK.

Jefferson and Monroe Streets,
CHICAGO.

GAS METERS,

Station Meters and Apparatus of Every Description.

REPAIRING CAREFULLY DONE.

THE POSITIVE PREPAYMENT METER.

OVER 600,000 OF THESE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES, AND THE DEMAND IS STEADILY INCREASING.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

SEND FOR OUR CATALOGUE AND OUR PREPAYMENT BOOKLET.